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West Europe Report

SCIENCE AND TECHNOLOGY

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SCIENCE AND TECHNOLOGY

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ADVANCED MATERIALS

SCHOTT R&D IN FRG ON HIGH TECH APPLICATIONS OF SPECIALTY GLASS

Duesseldorf VDI NACHRICHTEN in German 10 Jan 86 p 4

[Article by Hartmut Welfert: "Europe's Largest Specialty Glass Manufacturer Presses On With New Ideas". 30 Million DM for a Research and Technology Center"]

[Excerpts] Europe's largest manufacturer of specialty glass, the Mainz Schott-Group, was a technology enterprise from the very beginning. The Glastechnische Laboratorium Schott & Gen. founded in 1884 in Jena became the birthplace of a new chemistry of melt combinations. In order to retain its leading position, the company now invests 30 million DM in a new center for research and development.

In Lerchenberg, a suburb of Mainz, in the immediate vicinity of the ZDF [Zweites Deutsches Fernsehen] which operates Europe's largest television broadcasting center there, the coming months and years will see the creation of a research and technology center of the largest European specialty glass manufacturer, the Schott-Group which is part of the Carl Zeiss Foundation.

Roughly 30 million DM are slated for the first construction phase designed to enlarge by about half the previous 6000 square meters of research and development activities concentrated in the Mainz glass plant. Starting in 1988, 120 scientists will initially be working at Lerchenberg.

The impetus of research is, as is already the case today in part, on the development of specialty glasses and glass ceramics as problem solvers as well as in conceiving complete systems for electronics/optoelectronics and bio-technology/separation technology. Specifically, the intent is to develop know-how that can be sold to processing industries along with products of their own manufacture. As an example, reflection optics: previously only substrates were supplied, but now also the know-how on heating, nonglare properties, blind angle of vision of mirrors and many more.

Or in the area of integrated optics, which includes layers and fibers, it is not only a matter of individual "building blocks", but perhaps also of optical conductive layer systems, and more long-range maybe of basic elements for the "optical computer". This concept, however, seems a little premature yet to Dr. Heinrich J. Klein, the speaker of the board of Schott Glaswerke. But he defines Schott as a "technology enterprise commited worldwide, which also delivers for high-tech sectors." This refers primarily to optical glasses "which meet the extremely high demands upon homogeneity and transmission that could not be realized until now."

Among the latest orders is the construction of a chemical plant in the amount of 8 million DM including planning for the Czech foreign trade organization Technoexport in Prag. With a capacity of almost 30,000 metric tons annually, this acid concentration facility will be the largest unit supplied by Schott to date. Borosilicate glass is used predominantly, together with other corrosion-resistant materials.

The Chemistry Division, with annual sales of 250 to 300 million DM, is among the four largest branches of Schott. It includes the product groups Laboratory Glass as well as Instrument and Pipeline Engineering and has continued to grow for years now. The spectrum of products offered includes, among others, electrodes and devices for electrochemical application, glass for pumps, measurement and control panels, waste water lines of borosilicate glass and--from the production of Great Lakes Instruments in USA acquired only in 1984--instruments for automatic process control in chemical industries, petrochemicals and water treatment.

The second largest operational division of the "Schott's" is the branch Optics where close collaboration is achieved also with the associated foundations Carl Zeiss. Proceeds from optical glasses and systems are better than 400 million DM, at the Mainz plant alone 40% more than only two years ago. For one this is explained by the consolidation of the European and American camera industry, for another as a result of new products for high-tech industry, thirdly more than an average number of orders in the so-called project business.

To demonstrate, several orders were received for the manufacture of "Zerodur" reflector supports, as from the ESO for a telescope in South America. Schott proudly reports that they have succeeded in producing glass-ceramic reflector supports with a diameter of over 4 m. In collaboration with the California Institute of Technology the largest telescope in the world is presently being planned: its glass-ceramic reflector support, which will be comprised of individual facets, is to have a diameter of 10 m!

In fiscal 1984/85, which ended September 30, the Schott Foundation--made up of operations in Mainz, Wiesbaden and Landshut--has increased its sales by at least 9 percent to 730 million DM. With 1.35 billion DM, the Schott-Group Inland increased earnings by 8 percent more than in the previous year. Sales worldwide also rose by 8 percent to 1.68 billion DM. As a comparison: The specialty glass market of the Western World has a volume of 12 billion DM in round figures.

For the first time the number of people working for Schott in more than 100 nations exceeded 15,000 and is likely to continue to increase. In roughly 40 production facilities, approximately 50,000 articles are being manufactured. Almost two thirds of global sales are earned abroad, 52 percent from the export of products from the FRG. The most significant consumer countries--Italy, France and USA--each purchase for 100 million DM or more from the West German Schott-production; for years, Great Britain has been in fourth place. It is planned to consolidate in the near future the extensive activities in the USA in a holding company, the Schott Corporation.

Vast investments serve to secure the future: after 130 million DM in the year under report, 160 million are planned for capital expenditures in the current year, about 60 percent of which for the development and manufacture of new products and 20 percent each for rationalization and maintenance. With respect to personnel Schott is also in the process of reinforcing its entrepreneurial world format: not only in foreign subsidiaries, but gradually also in the Mainz headquarters, management positions are increasingly filled according to international standards, meaning qualification comes before nationality.

Unchanged, however, shall be the legal status as a foundation. There are no private or state holdings, such as partners or stockholders. Therefore, Schott (the same as Zeiss) must produce with its own resources the capital required to maintain the status quo and for continued growth; although they do not have to pay any dividend, but must merely maintain the Carl Zeiss Foundation in Heidenheim which, in turn, is committed to the welfare of the two foundations, their employees and to the promotion of science and technology.

13011/12951
CSO: 3698/325

ADVANCED MATERIALS

BRITE OF EC, BMFT OF FRG FUND ADVANCED MATERIALS RESEARCH

Duesseldorf VDI NACHRICHTEN in German 27 Dec 85 p 16

[Article by Horst Czichos: "Research for New Raw Materials is International in Scope. More than one Billion DM for Federal Material Research."]

[Excerpts] In the industrialized countries, raw material and material technologies are increasingly regarded as significant key technologies for future technoeconomic developments. This assessment is based on the fact that materials as structural and functional raw materials for machines, instruments and installations constitute the tangible basis of technology as a whole. The continued developmnet of technical products and creation of new technology and industrial sectors thus also requires the constant improvement and new development of materials, taking into account increased demands upon reliability, safety, competitiveness and environmental concerns.

Research activities in the field of material research in the EC-area are characterized both by intensified efforts in the form of national activities on the part of the individual EC-member nations as, for example, England and France, and by measures taken by the EC-Commission.

In August 1983, the British Secretary of Industry and Technology, Kenneth Baker, established a "Materials Advisory Group" who in the beginning of 1985 submitted its concluding report "A Program for the Wider Application of New and Improved Materials and Processes." This report recommends that over a period of 5 years with 50 percent industrial interest a 120-million-Pound project be undertaken in the areas of composite materials, engineering ceramics, metals and alloys with specific microstructures produced by rapid quenching, electronics materials, manufacturing methods for final shaping, surface and joining techniques as well as monitoring systems for processes and operations of components and technical systems.

In France also, a French study published in 1983 on the subjet of material research highlighted a number of priority areas where more in-depth know-how and the development of certain material classes and process engineering methods should be achieved to the point of industrial maturity. In addition to materials that are important for advanced technologies, such as polymers, ceramics, amorphous and microcrystalline substances the particular recommendation is also for the promotion or research work on the material sector for construction industry. The main thrust is on new materials for residential construction.

For the entire region of the European Community and ahead of the political objective of creating a common EC-inland market, the Commission of European Communities intensifies its efforts for the promotion of technology, particularly in the area of material research. On the basis of a study prepared by the BAM [Federal Institute for Material Research], the EC--Executive Board XII Science, Research and Development--has established the research program BRITE (Basic Research in Industrial Technologies for Europe), which was provided with an EC promotional budget of 136 million ECU (approximately 350 million DM) for a duration of 4 years. Among others, the BRITE-program includes the areas of reliability, material wear and tear, polymers, composite materials as well as flexible materials, i.e. textile technologies.

In response to the call for bids published in the official bulletin of the EC for the BRITE research program, about 550 research applications had been submitted by May 1985, which had to comply with the following conditions: Collaboration among institutions from at least two EC-nations, participation of at least one industrial firm in a project as well as participation of the industrial partner with 50 percent of the cost of a respective project.

A judging panel of experts with representatives from all EC-nations selected from the project applications submitted to the EC about 100 projects for a first subsidy period of two years, whose assistance is slated to start within this year.

Although material research in Germany has a good tradition, it has so far not been promoted and supported to a degree corresponding to the developments in USA and Japan. For the coming years the Federal Department for Research and Technology (BMFT) has now developed a new material research program which is planned to last 10 years and was introduced by Secretary Riesenhuber on October 11, 1985.

After careful consultation with numerous experts five crucial points have been selected for which a high innovation potential can be anticipated: ceramics, powder metallurgy, metallic high-temperature and specialty materials, new polymers and composite materials.

Within the limits of the keypoints of the program, materials are to be developed having new and improved usage on manufacturing properties. General technical R&D-objectives for this are:

--High-temperature resistance with differing temperature limits for different material classes.

--High structural strenght and rigidity with lowest possible weight, particularly in light construction.

--High wear resistance and hardness; wearing quality is greatly depedent upon material combination, type of stress, environment etc.

--High (chemical) corrosion resistance; the matching of material-corrosion medium is critical.

--Technically exploitable functions (optical, electrical, electronic, magnetic) in the case of polymer materials. The combination of the above functions with other advantageous properties of polymers (e.g. low weight, economic to produce, non-corrosiveness) promises a tremendous application potential. Technically conductive functional polymers may become a revolutionary basis innovation.

Material characterization, reliable material testing that is non-destructive to the greater possible degree, is always a primary concern of development. And it is the very subject spheres included in the five keypoints where it presents considerable difficulties. Non-destructive testing during manufacture has special significance during production; on-line testing is a condition for process control and automatic production processes. Sufficiently accurate and rapid measuring methods are lacking in broad areas and have to be developed. The new material research program of the Federal Government provides for a period from 1985 to 1994 federal research expenses of 1.1 billion DM, increasing from 79 million DM in the year 1985 up to 119 million DM in the year 1988.

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ADVANCED MATERIALS

BRIEFS

FINNISH STRUCTURAL CERAMICS--The Finnish companies Wartsila and Partek have created under the name WP-Ceramics, a company specialized in industrial ceramics, the first of its kind in Finland. Sitra (Fund for the 50th Anniversary of Finnish Independence) has participated in the project with a preliminary study of these products, and expects to participate in the acquisition of a "small production line." WP-Ceramics, which should employ about 15 specialists during this year, will limit its initial activities to studying applications of non-clay ceramics in mechanical construction. Finnish education and academic research organizations should also benefit from the research resources developed in this case. [Text] [Paris CHIMIE ACTUALITES in French 20 Jan 86 p 9] 11,023

SEP-RHONE POULENC CERAMICS--As expected (see our issue of 21 October, p 2), Rhone-Poulenc and SEP have reached a cooperation agreement for the joint development of silicon carbide and carbide-nitride fibers, whose first applications are anticipated in the aerospace sector, beginning with thermal protection for the future European space plane Hermes (p 4 of our 28 October issue). According to a joint statement from the two companies, Rhone-Poulenc's Saint-Fons (Rhone) center and SEP's Bordeaux-Le Haillan center will be primarily involved in this development. SEP, which has perfected ceramic-ceramic structural composites, wants "to see to it that the fibers which are one of the basic components of these composites, are developed and reliably produced in France," while Rhone-Poulenc has recently created in its fine minerals division, a ceramics department concerned with the development of powders and fibers. For Rhone-Poulenc, silicon carbide and carbide-nitride fibers are in fact "a natural extension of the knowledge gained in silicon chemistry and in polymerization and spinning techniques." [Text] [Paris CHIMIE ACTUALITES in French 20 Jan 86 p 9] 11,023

CSO: 3698/297

AEROSPACE

DIFFERENCES BETWEEN HERMES, U.S. SHUTTLE HIGHLIGHTED

Zuerich DIE WELTWOCHE in German 6 Feb 86 p 29

[Text] For years the space shuttle Hermes has been a favorite child of French space planners, who regard the Hermes as the best way to guarantee the Europeans absolute equality in manned space flight. And yet such a space shuttle would only be the logical conclusion of a development that is underway in any case. For in response to French urging, a dozen member states of the European Space Agency ESA decided years ago to regularly upgrade the European rocket. The first version was able to carry about 1,750 kg into space; the Ariane-2 had a payload of 2,000 kg, and the Ariane-3, 2,500 kg. This year a major step forward has been taken. For the first time, the Ariane-4 is to be used, which is able to launch more than four tons into space.

The Ariane-5 will be the non plus ultra. Realistically speaking, this is no longer merely a further development of the previous Ariane rockets, but rather it is a new, powerful space projectile. With a weight of 550 tons and a length of 45 meters, this rocket, which is the largest used to date in Europe, will be able to launch a payload of 15 tons into an orbit 400 km high, and is able to transport five tons into geostationary orbit 36,000 km above earth's surface. From the point of view of its launching power, such a projectile can also be used for manned space travel as well. The first space capsules of the Americans, which carried one crew member, weighed barely two tons, the first Russian space capsules less than five tons.

Today the French are attempting to interest the other ESA member states in co-financing the costly space shuttle. Experts estimate that at least DM 7,5 billion will be needed. Very specific ideas already exist as to the design of the European space shuttle, which will be a winged space craft similar to the American space shuttle. The French space agency CNES (Centre National d'Etudes Spatiales) describes Hermes as having a length of 16 meters and a width of 10 meters. The space craft should weigh about nine tons before fueling. The payload is given at about 5 tons. Normally there will be four crew members on board, but six persons could travel in the small space craft. In comparison, the American shuttle has quite different dimensions. With its booster tanks it is 56 meters long, with a breadth of 24 meters. While Hermes has a payload of only 5 tons, the American craft is able to lift 30 tons into low orbit.

But this comparison does not tell the whole story. The shuttle can only reach lower orbits of several hundred kilometers. If, for example, communications satellites have to be transported into geostationary orbit at 36,000 km, they must be unloaded from the shuttle and raised again via a secondary rocket--a complicated and very costly procedure, and one that is not fully reliable. The situation is quite different for Hermes. The Ariane-5 rocket can lift the craft directly into geostationary orbit and thus can also launch the 5 ton payload directly into geostationary orbit, despite Hermes' modest proportions.

At CNES, three different types of utilization are envisioned for Europe's space shuttle. In the first place, with two to four astronauts, it could be used as a manned research platform for a period of three to four weeks in space. The second possibility, according to CNES, would be to hook-up with manned and unmanned space platforms, in order to exchange experimental procedures, make repairs, bring fuel on board, etc. The third application for Hermes points further into the future. By the end of the century at the earliest, Hermes could become a supply vehicle for a purely European space station.

The explosion of Challenger could affect the realization of the Hermes plans in that the European partners might conceivably hesitate to go ahead with the project. The French themselves have in the past pointed out that the small space shuttle they are designing is considerably simpler and safer than its American counterpart. According to this view, Hermes does not have its own power source, but rather sits as a payload, so to speak, on the gigantic Ariane-5 rocket. This also entails a decisive advantage for structural reasons, and one which appears even more important after the Challenger catastrophe; one could return to an invaluable device formerly used in manned space flight. For all previous American and Soviet rockets, there was a so-called escape hatch at the top of the rocket. If a malfunction threatened, this escape hatch under its own power separated the manned space capsule from the launch rocket, lifted it high into the air and let it parachute to earth, a safe distance away. This possibility no longer exists for the heavy American space shuttle. The American astronauts, particularly during the first few minutes following launch, are completely dependent on the proper functioning of their space craft. With the smaller and simpler Hermes, it would be quite possible to include an escape hatch in the design of the craft.

Whether this small but important difference will now stimulate France's European partners despite everything to give a green light for the financing of the space shuttle remains to be seen. In any case, Paris remains optimistic. After the explosion off the Florida coast, Technology Minister Hubert Curien once again urged that plans for Hermes be moved rapidly ahead.

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AUTOMOBILE INDUSTRY

RENAULT OF FRANCE INVESTS FR 5 BILLION IN NEW MODEL

Paris LA TRIBUNE DE L'ECONOMIE in French 23 Jan 86 p 12

[Article by Ar. R.: "Renault Invests Over 5 Billion in the R 21"]

[Text] Following the R 25 at the top of its line, and the Supercinq at the bottom, Renault is replacing its R 18 with the R 21 to "close a breach." It now only needs to prepare the R 9 successor, and especially to straighten out its financial situation.

Renault has invested 5.08 billion francs, of which 1.4 billion in Sandouville, to put out the R 21, which will replace the R 18 beginning in March. (Footnote 1) (At Sandouville, 762 million francs were invested in sheet metal, 329 million in stamping, 118 million in painting installations, 117 million in assembly, and 83.6 million in new buildings. Renault's overall investment of 5.08 billion francs breaks down as follows: 1.69 billion for study costs, 364 million for methods, 658 million for start-up, and 2.36 billion for industrial investments.) Essentially manufactured at this plant near Le Havre, which already builds the R 25, the R 21 will also be produced at Maubeuge, at Douai, at Haren in Belgium, and in Spain. All in all, slightly more than 1000 units should roll out from Renault plants as early as June.

According to company officials, this distribution among several production units, generally used for the R 21, answers the need to "manage poverty." Renault, which is tightening its belt to straighten out its financial situation and face its overstaffing problem--9000 more people should be laid off this year, does not have a choice.

The introduction of the R 21 was imperative to "close the breach" between the R 11 and the R 25, and especially to complete the upgrading of the line. The R 18, launched in 1978, had dropped to 1.6 percent of the French market and 0.6 percent of the European market, after having peaked to 9 percent and 3 percent of these respective markets in 1981.

Today, the company will say absolutely nothing about sales objectives. It fully expects to exceed some of the heights reached by the R 18 in its time, and to compete with the Peugeot 305, Citroen BX, Audi 80 and 90, and so on.

The stakes are high: one out of four buyers in Europe is a customer for this type of car, called the "higher intermediate" range.

This model should also represent a means to regain the American market: it will be introduced on the other side of the Atlantic in March 1987 with a sales objective of 60,000 units per year.

With its new car, Renault wants to meet three major challenges: offer a uniform slate of remodeled products; prove that it can guarantee a level of quality that is at least equal, if not higher, than that of its competitors; and find a way to return to profitability.

The latter point will obviously not be settled this year, "but the most important check point is in two years," asserts Patrick Faure, general deputy of the company.

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CIVIL AVIATION

AIRBUS COMPETES FOR JAPANESE AIRLINE ORDERS

Paris LA TRIBUNE DE L'ECONOMIE in French 23 Jan 86 p 12

[Unsigned article: "The Japanese Company ANA Rekindles the Airbus-Boeing Battle"]

[Text] The Japanese company All Nippon Airways (ANA) wants to update its fleet. The three large aircraft manufacturers, Airbus, Boeing, and Mac Donnell Douglas, are once more in the arena to meet ANA's requirements. Having just ended a two-year bloody fight, ultimately won by Boeing, the American company obtained a contract of 14 billion francs in December, to deliver 25 767 model planes for replacing ANA's aging Lockheed-Tristars and Boeing 727's.

This time, ANA wants to modernize its Boeing 737 fleet and satisfy its growing domestic traffic. At stake is an order of 10-20 planes which should be placed in service at the end of the decade, with each plane costing more than 260 million francs.

ANA has created a committee led by the company's vice-president, with the task of selecting the best plane or planes, as well as the exact number of aircraft to be bought; its conclusions are expected in July.

Until then, technical and economic arguments, as well as political and diplomatic pressures will increase, as they did during the preceding battle for the 767. The Japanese aircraft manufacturers will not fail to support Boeing, and for good reason! They produce 15 percent of the 767, they have just collected $500 million in sub-contracts for the 747, and they are associated in the American project for the 7X7, a 150-seat plane competing with the Airbus A-320.

However, the European consortium does not despair, and once more picks up the challenge. Its trump card is to dangle a Japanese association in the TA-9 and TA-11 projects, just like Boeing.

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CIVIL AVIATION

FLOSDORFF TO BECOME AIRBUS GENERAL DIRECTOR

Personal Background

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 14 Jan 86 p 3

[Text] Hamburg, 13 January--Heribert Flosdorff, director of development of the Messerschmitt-Boelkow-Blohm (MBB) GmbH's civil aviation and transport aircraft division in Hamburg/Bremen, is slated to become the new general director of Airbus Industrie in Toulouse. Agreement on his selection was reached by the members of the European Airbus Consortium, in the presence of the current Airbus chairman of the board of directors, Dr Franz Josef Strauss. An MBB spokesman has confirmed this fact. Final appointment by the board of directors will take place on 27 January. Flosdorff, 53, has an engineering degree and will succeed Johann Schaeffler, who in April 1985 became the first German Airbus general director and who will now become chairman of the board of the Dornier Aerospace Company.

Flosdorff had worked for several years for the German Research and Testing Institute for Air and Space Travel (DFVLR), prior to starting in 1967 as director of the project office for the North German MBB Enterprise Group. He has been director of development since 1975. His nomination to be general director, the number two position in Airbus Industrie after French President Jean Pierson, is said to have primarily been initiated by Hamburg MBB chief Hartmut Mehdorn, who himself had been in charge of Airbus production in Toulouse for 4 years prior to joining MBB in April 1985. Flosdorff's appointment is obviously designed to keep the German Airbus partners from losing status in the European aircraft manufacturing consortium, in which the French have lately raised their influence in the personnel sector to a considerable degree.

Organizational Problems at Airbus Industrie

Hamburg DER SPIEGEL in German 13 Jan 86 p 85

[Article: "Inexplicable Haste"--The Germans in the Toulouse Airbus Works Complain About Being Disadvantaged. Now a New Top Executive Arrives From Germany]

[Excerpts] Flosdorff, 53, is hardly known outside the aircraft construction industry. Possessor of an engineering degree, he has been director of development of the MBB works in Hamburg-Finkenwerder since 1975. He started there in 1967 as chief of the project office.

Flosdorff can primarily thank Hamburg's MBB chief Hartmutt Mehdorn for his rapid climb to the top echelon of Airbus: It was Mehdorn who recommended him for the job. Mehdorn, who himself was in charge of Airbus production in Toulouse for 4 years, credits Flosdorff with total familiarity with the Airbus program.

Others, however, doubt that the talents of the MBB engineer are sufficient for the high-level job in Toulouse. It requires more than technical knowledge: The general director of the international consortium moves in a very sensitive field of force. He must represent the interests of the German partners, without, however, endangering the freedom of action of the four-nation firm. This requires great assertiveness and diplomatic skills.

Even his predecessor, Johann Schaeffler, for whom there was general praise when he went to Toulouse, fulfilled the hopes placed in him only to a limited extent. His teamwork with Airbus President Jean Pierson, who had also been newly installed, was not good.

Pierson, a beefy Frenchman, who likes to lend emphasis to his words with expansive gestures and by occasionally banging his fist on the table, developed within a few months into the strongman at Airbus Industrie.

In contrast to his predecessor Lathiere, who controlled the firm long-distance from Paris, Pierson made a point of settling in Toulouse. Differently also from Lathiere, who concerned himself only with the big picture and left the details to his deputy Roger Beteille, Pierson also gets himself involved in the details of every-day business.

To begin with, the former director of the French Aerospatiale energetically dismantled the internal Airbus organization. He took personal charge of the sales division and reorganized other departments to his own liking.

Complained one Airbus manager: "Existing structures were destroyed with inexplicable haste, and employees were transferred, promoted or demoted like so many slaves."

Especially the Germans working in Toulouse consider themselves disadvantaged by the reorganization. As an example, the technical "Current Programs" department was merged with "Flight Testing" and Bernhard Ziegler, a Frenchman, was appointed its head. The former technical director, the German Jean Roeder, has since then been in charge only of Future Projects.

Customer Services too, formerly headed by a German, became a department of its own under the directorship of a Frenchman.

During a staff meeting, there were bitter complaints by the Germans. One speaker expressed regrets over the "uncompromising autocracy" of the French and the "clear tendency of purposely squeezing us out of all important positions."

Airbus President Pierson is making good use of his home advantage in Toulouse. German experts can be persuaded to move to France only with great difficulty, if at all. Pierson on the other hand, has no trouble recruiting experts from the French Aerospatiale firm; it is located right next to the Airbus factory area in Toulouse.

The German Airbus people working in Toulouse make themselves no illusions that the new general director will be able to change the personnel ratio from one day to the next. But they do hope that the new man will better represent the interests of the Germans, who after all have a 37.6 percent share of Airbus, than has been the case in the past.

Flosdorff wants to wait and see. He admits to knowing that the balance of power in Toulouse is wrong. But, says the new man about his new job, he is "not about to take on a bag of troubles sight unseen."

Other Appointments

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 29 Jan 86 p 16

[Article: "Airbus Enlarges Its Aircraft Model Family"--Two New Models/ Flosdorff Confirmed as Schaeffler's Successor]

[Text] Airbus Industrie, Blagnac near Toulouse--The board of directors has approved the development of two new aircraft types: the twin-jet model formerly designated with the working title "TA-9," in the future to be known as the A-330, is to be built as a medium- to long-distance wide-body aircraft for 310 passengers. The future A-340, heretofore bearing the project designation TA-11, is planned as a four-engine aircraft for very long distances with a 260-seat capacity.

Airbus Industrie President Jean Pierson stated that this would be the last major investment requested of the Airbus partners, which would enable Airbus Industrie to offer the intended full range of aircraft. Together with the two new aircraft which are to enter the market in the early 1990s, he continued, the complete program would include the A-320, an intermediate transport aircraft for 150 passengers, up to wide-body aircraft for 400; flight ranges would extend from 550 to 13,000 km. In accordance with their respective partnership shares, the FRG and France were expected to contribute $1 billion each and Great Britain $500 million.

The board of directors also settled the outstanding executive personnel questions. Heribert Flosdorff of the German MBB will succeed Johann Schaeffler on 1 February as general director of Airbus Industrie (see FRANKFURTER ALLGEMEINE of 14 January); Stuart Iddles from Great Britain, currently employed by British Aerospace, will become Senior Vice President/Commercial. He will succeed Pierre Pailleret. Angel Hurtado from Spain, presently director of contracting with the Spanish aircraft manufacturing firm Casa, will succeed Georges Ville as Senior Vice President/Procurement on 1 March.

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CSO: 3698/321

CIVIL AVIATION

FRG TO FUND AIRBUS A-330, 340 DEVELOPMENT

Bonn DIE WELT in German 3 Feb 86 p 9

[Article by Heinz Heck: "New Models Require Billions in Financial Support From the FRG"--Stoltenberg's Position Unknown]

[Text] Bonn--With a change in Airbus funding the FRG Government aims at a greater share for German industry in European aircraft production. First of all, however, billions of new support funds will be required. Federal Chancellor Kohl and CSU Chief Strauss have apparently already reached agreement. The position of Stoltenberg, whose efforts to bring about smaller budget increases are thus being undermined, is not known.

According to official statements, nothing has been decided as yet. But it is fully accepted that Bonn alone will participate in the funding of development costs for the two new models, the A-340 (long range version) and the A-330 (wide-body medium range version) with a contribution of DM 2.5 billion (estimated overall cost: $2.5 billion).

Strauss, in his capacity as chairman of the board of Airbus Industrie, has in any case stated that the partners in the European enterprise will provide the funds for this stage of the project. Bonn is also under pressure from Paris. The German refusal to participate in the French Hermes space shuttle has provoked anger in Paris which is in the middle of an election campaign. Kohl has already assured Mitterand of contributions for enlarging the Airbus family. For this purpose alone, FRG funds of DM 500 million per year will be required between 1987 until the early 1990s.

For all this, the development costs of the A-320, which will presumably enter the market in 1988, have not yet been firmed up. In February 1984, the cabinet had approved conditionally reimbursable subsidies of up to DM 1.5 billion (90 percent of estimated costs); plans call for a flow of DM 765 million annually between 1986 and 1988. From 1988 on, marketing fund supplements will be added to this for the "definitive German cash share."

The planned change in production financing may have an even stronger impact. The basic intention is to furnish no-interest, conditionally reimbursable Federal subsidies rather than FRG fund guarantees. This would drop the entire interest burden into the lap of the FRG. Inasmuch as the enterprise's entry into the black side of the ledger keeps being postponed with every new model, the reimbursement feature becomes downright symbolic. According to information from the Finance Ministry, the payment guarantees for the Airbus presently amount to DM 4.1 billion, of which about DM 3 billion have been expended.

The official justification for transferring the funding costs, including those for mass production, to the FRG is that this is the only way in which the German private sector can be expected to continue participating. The cost pressure resulting from high interest rates is said to be so enormous that there is a danger that costs could get completely out of control.

The Federal Accounting Office recently stated in its 1985 "Comments" that the FRG's "efforts to reduce the risk arising from assuming funding guarantees for series construction funding for Airbus aircraft and to increasingly transfer responsibility therefore to private industry, have not yet been successful." However, the top accounting agency does not include in its comments the suggestion that this be promoted by taking over the loan interest.

Apart from the considerable supplementary burden on the Federal budget, some thought should be given to increasingly bitter arguments with U.S. competitors, who have already protested support measures taken to date all the way up to the President. In view of favorable U.S. export financing, among others through the Exim-Bank, the European competitors have until now always been forced to pay enormous interest charges in order to be competitive. This results in the efforts to create a tendency of approaching market conditions in both the United States and Europe. The new subsidy measures may well torpedo these efforts.

9273/12766
CSO: 3698/321

COMPUTERS

BULL STRATEGY FOR NEXT 2 YEARS, RECENT INVESTMENTS, PRODUCTS

Financial Position

Paris LA TRIBUNE DE L'ECONOMIE in French 16 Jan 86 p 15

[Article by Michael Cahier: "Improvement Stimulates Ambition"; passages within slantlines published in boldface]

/The gross self-financing margin of the group in 1985 exceeded, for the first time in 3 years, 4 percent of the revenue. With a probable level of 7 percent, the 1985 fiscal year is whetting the appetite of the group, especially in its technological choices. The 1985 trading results of the Bull group confirm the spectacular recovery of the number one French computer manufacturer: sales will reach 16 billion francs with a cash flow of more than 1 billion francs and a final net positive result after cumulative losses of more than 2 billion francs since 1982. The new result relative to total permanent assets should finally return to a more orthodox ratio between 0.2 to 0.3, as compared to 0.08 in 1983./

[Text] People in financial management are more relaxed. However, a few weeks from official publication of the results, it is difficult for them to talk about "limited interest," the convertible securities and bonds of which are dealt with on the Stock Exchange. Even more so because of the stock outlay contributions of the government, which amounted to 1 billion francs in 1984, another billion in 1985 and will amount to a third billion in 1986, which is one of the essential causes underlying this recovery. Among other causes, there is obviously the modernization of all the manufacturing equipment and the realignment of product strategies concentrating on several strong points.

Part of the Market Is Still Weak

Renovating the Angers factory, which manufactures the DPS7, the group's workhorse in the medium-power computer line (1985 sales: approximately 3 billion), the Marcq-en-Baroeul factory, and building the Villeneuve-d'Ascq factory will have used up 2 billion in funds already invested by the government, although it is at the third site that the office automation terminals (Bull Transac) and Micral 30 microcomputers (Bull Micral), whose sales have increased fourfold in 1985, will be produced. Micral revenues will exceed 1 billion francs in 1985 with 29,000 deliveries, or half the sales of the IBM PC. Bull has thus become the second largest French manufacturer and seller of microcomputers, due to the total reorganization of the marketing network and a compatible product designed elsewhere (Footnote 1: The Micral was designed by REE [Realisations et Etudes Electroniques], created by A. Truong in 1972 and purchased by CII-HB in 1979) and produced in a rational fashion. The group will soon introduce a new Micral (the Ajax) similar to the IBM PC AT. These financial outlays confirm a manufacturing strategy which 2 years from now will devote 90 percent of the group's activity to mass-market products.

In sum, the group will have invested 3 billion over a period of 2 years (1984 and 1985) in the business and the commercial network with the clear desire to "take Europe by storm," where it controls approximately 25 percent of the market, which is, according to general manager Francis Lorentz, still "not good enough." The demand for the most expensive items on the market is the lowest, a well-known phenomenon in food marketing; this has raised several questions concerning future sales methods. At present, the greatest difficulty at Bull is "managing coherent and homogeneous lines over time."

As a result, there has been a burst of contracts and partnerships, from the largest (NEC and Siemens) to the smallest (Copernique), for the Diram 32 disk controller regulator, the goal of which is to circumvent the European maneuvers of IBM for computers and ATT for telecommunications. This explains the emphasis placed on the notorious DSA/OSI (Open System Interconnection) standard, promoted by 12 European manufacturers in response to IBM's SNA standard, of which a great deal is expected for the "line" of public networks, especially at Bull, where the standard has been "labored over" for more than 10 years.

This is a European dream, still worked toward and revived despite rude awakenings (such as Transpac, which Jacques Stern, president of the group, attempted for several months to impose on Brussels) in which many professionals no longer believe: "All that is just idle community chatter which allowed IBM to deliver while we were talking," said an independent manufacturer. In local networks, IBM has already triumphed by imposing its standard, except at Rank Xerox (where Eternet is the standard) and ATT (Starlane), although it involves a battle of giants who have huge sections of the market. Can France, which represents approximately one-twentieth of the world computer market, even within the framework of European alliances, impose a standard? Many suspect the motives, because in the computer realm, the total of 10 times 5 percent does not add up to 50 percent of the market.

Another Poker Strategy

The danger is serious and can be precisely expressed: The CP8 memory card with (excessive?) "universal" applications, which was the object of considerable effort in the United States, where Bull created a subsidiary (MCTI, Dallas) from the ground up to analyze its market, determine its targets, and find "alliances," is another poker strategy. Already, some Europeans are demanding that the position of the thumb on the card be moved, which indicates a second standard and a second reader, resulting in an increase in selling and use costs.

Beyond the 1985 results, which are heartening, the long term, for which the bottom line of the operating budget is unknown, nevertheless remains a big question mark. Aware that it is impossible, when your name is Bull, to finance your own commercial network on a worldwide scale, Mr Lorentz believes that "the customers do not want just one standard, which does not," he added, "constitute a revolution." Is this the will of the engineers to justify their choice of technology in the name of principles of independence expressed by the customers?

Mr Andre Truong, inventor of "Micral," which today is contributing to the return of cash flow to Bull, has often said that he had never been able to impose IBM compatibility for the Micral on his engineers: "The engineers said the customers are afraid of a single standard." The debate still remains open. The reunion of growth and health, with manufacturing and commercial energy long since having taken off, reassure the group's decision makers about a technological strategy which will not appear in 1985 accounts. For the time being, ambition and cash flow are in the future. This is already better than the 2 million in losses that occurred over a period of 3 years.

Groupe Bull : résultats consolidés

		1982	1983	1984	1985	
(1)	Ventes (millions)	8.134	11.639	13.596	16.000	
(2)	Marge brute					
(3)	autofinancement	(583)	328	573	plus de 1.000	(5)
(4)	Résultat net	(1.351)	(625)	(488)	—	
(6)	Valeur ajoutée	4.544	6.645	7.323	—	
(7)	Résultat brut exploitation	511	1.554	1.723	—	
(8)	DAFIC (1)	(307)	(215)	(1.027)	—	
(9)	Situation nette	(46)	468	1.178	—	
(10)	Dettes moyen long terme	2.619	3.648	3.519	—	

(11) (1) DAFIC : disponible après financement interne de la croissance, c'est-à-dire après investissements industriels et financiers.

Groupe Bull: consolidated results

Key:

1. Sales (millions)
2. Gross margin
3. Self-financing
4. Net result
5. more than 1,000
6. Profit
7. Gross operating results
8. DAFIC*
9. Net position
10. Average long term debts
11. *DAFIC: (Disponible apres financement de la croissance) available after internal growth financing, i.e., after manufacturing and financial investments

Modernization of Manufacturing Facilities

Paris ELECTRONIQUE INDUSTRIELLE in French 15 Jan 86 pp 73-74

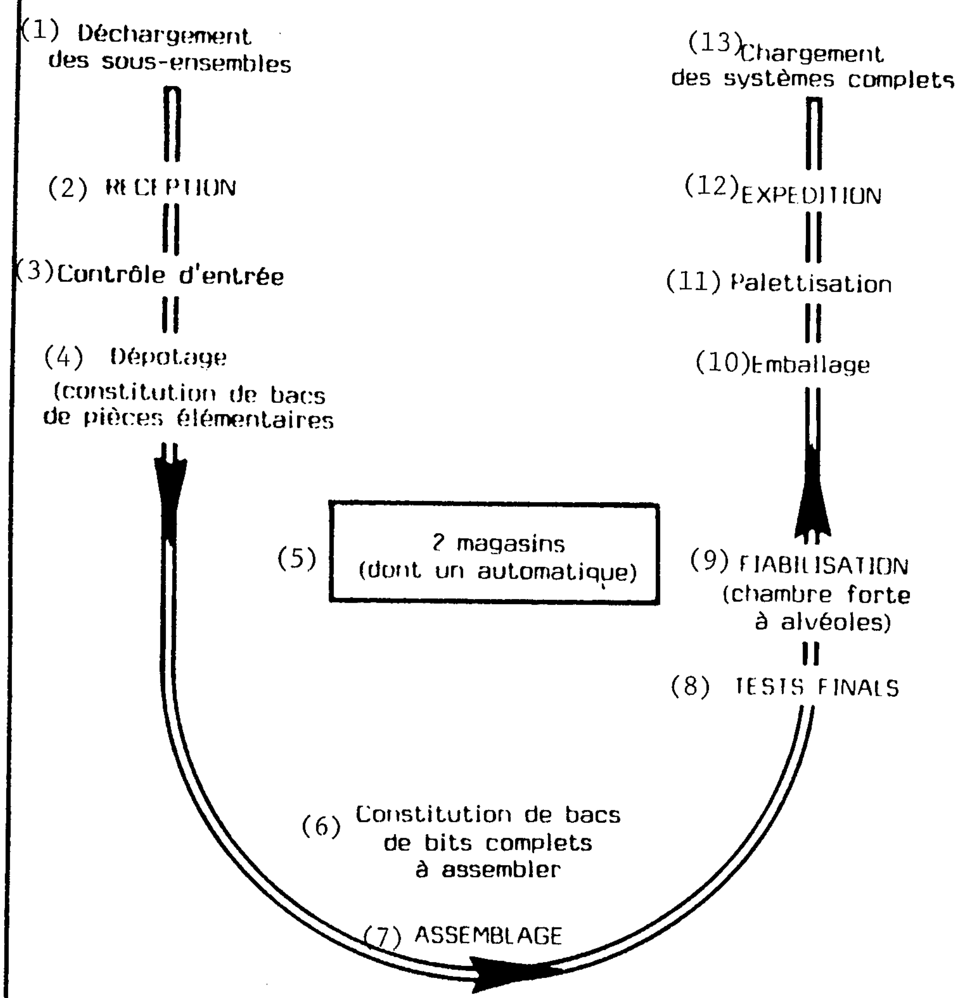
[Article: "Modernizing 'Made in France', An Essential Priority for Bull"]

[Text] "The reduction in average computer prices by approximately 20 percent per year, for equal performance, is a fact of life for computer manufacturers," stated the manufacturing manager of Groupe Bull, Christian Marchand. To adapt to this constrained position, the French firm, which plans to exceed its revenue by 50 percent in exports between now and 1990 (as compared to 36 percent today), has concentrated in large part on the modernization of its equipment. Total manufacturing and commercial investments have shown a great deal of growth in the past few years: 636 million francs in 1983, 1,108 million francs in 1984 and almost 1,500 million francs this past year, or 9 percent of a total revenue estimated to be 16 billion francs. Such an outlay that Francis Lorentz, Bull's general manager, forecasts for 1986 and the coming years an outlay level of 8 percent, so as not to weaken the financial situation of the firm, which is currently on the road to health. The return to net profits is forecast for this year.

Modernization of the manufacturing equipment has taken two forms in the French firm: the creation of new sites and the renovation of existing sites. At the forefront is Bull's pride and joy: the Villeneuve-d'Asq (Nord) factory, which has produced Micral microcomputers and Questar office work stations for the Transac division since the beginning of 1986. This new site represents a total investment of 220 million francs (it replaces the site the firm had been using at Marcq-en-Baroeul, which has in fact now been returned to Thomson, who uses it to produce equipment connected with the American RITA contract. The integral automation of material flow (in particular, with wire-guided conveying devices) composed solely of partial assemblies and macrocomponents (subcontracted) which will subsequently be integrated, tested and qualified on-site, along a U-shaped assembly line is being implemented (see figure). The novelty resides particularly in the actual flexibility of the production equipment, which it is now possible to reconfigure within a few hours by computer. In other words, models or different configurations may be assembled quite rapidly in response to demand. A general idea of the degree of automation can be derived from the following figure: the value added on this site is on the order of 5 to 10 percent of the final profit on the product.

Another new manufacturing site is currently entering the operational phase: the one at Trappes (Yvelines) where microprocessor payroll cards are manufactured by the CP8 subsidiary of Bull. There are large workrooms where dedicated machines carry out the personalization of the cards on an assembly line. Its production capacity is currently approximately several million cards per year, and CP8's goal is to reach an annual capacity of 10 million units at the end of this year.

Set up in Belfort 25 years ago, in buildings some of which are more than 100 years old, the Peripheriques subsidiary of Groupe Bull has apparently heavily invested in the installation of the Mathilde assembly line. This name



Organisation de l'espace de production dans l'usine automatisée de Villeneuve-d'Asq.

Organization of the Production Floor in the Automated Villeneuve-D'Asq Factory

Key:

1. Unloading of partially-assembled systems
2. Receiving
3. Input monitoring
4. Storage (preparing for component parts)
5. 2 warehouses (one automated)
6. Preparation of containers for complete bits to be assembled
7. Assembly
8. Final tests
9. Reliability testing (honey-combed reinforced chamber)
10. Packaging
11. Pallet loading
12. Dispatching
13. Loading of complete systems

designates a top-of-the-line printer using magnetographic technology designed by the French firm, and its production in large quantity actually began at the end of 1985. This represents a manufacturing investment of 100 million francs over the past 2 years and should allow the production of more than 1,000 printers this year.

However, the manufacturing modernization policy undertaken by Bull is probably most significant at the Angers factory, where the most is at stake. On this site, the French firm produces its medium and large systems (DPS 7 and 8), key elements of its computer line. In terms of investments, Angers and Joue-Les-Tours (close to where the DPS 6 are produced) have benefited from large and regular sums during the period: 90, 160, then 225 million francs in 1983, 1984 and 1985, and then almost 200 million francs, which will be invested in 1986 to result in an entirely renovated factory at the end of 1988. Outlay has primarily involved automation of material flow and the integration of technical and management data information processing.

Simultaneously with the investment in machines, the French Groupe is investing in its personnel. An extensive quality training program has involved all personnel between 1983 and 1986, for approximately 1 week per person. On the Groupe level, 80 quality circles and 125 quality improvement groups have also been created, a necessity, considering that Bull's estimate that total cost of "non-quality" is 30 percent of the profit for one of its products. Management's goal is to approach a zero-deficit level in 1988.

And employment? Those at Bull are quite circumspect and refuse to be pinned down about hiring forecasts. The tendency at the Groupe level is a stabilization in the number of employees. A total of 26,000 people represents a significant burden, especially with regard to ambitions for a permanent return to net profits.

Ajax Launched

Paris ELECTRONIQUE ACTUALITES in French 31 Jan 86 pp 1, 4

[Article: "The Micral 60 Starts Up Without Xenix or Local Networks"]

[Text] As planned, the "Ajax" project resulted last 28 January in the introduction of the Micral 60, Bull's AT-compatible, 9,000 units of which can be produced starting this year.

With three basic versions offered, it runs on DOS and Prologue, although Bull did not adopt Xenix, which it considers not yet standard, just as, for the same reason, it did not offer a local network except for SPR, which works only with Prologue.

Based on an 80286 microprocessor with two basic cycles (6 and 8 MHz), the Micral 60 was introduced by Francis Bacon, Bull Micral's commercial manager, as being six to seven times as fast as the Micral 30 and 20 percent faster than the IBM PC. It also accepts an 80287 microprocessor with floating decimal as an option.

Its three basic versions include one having two 1.2 megabyte diskettes, the second having one diskette and a 10 megabyte hard disk, and the third having one diskette and a 40 megabyte hard disk.

In the near future a version with a 20 megabyte hard disk will be offered, and the possibility of connecting higher capacity hard disks is under study. In total, the Micral 60 has six peripheral connections which allow its configurations to be expanded by a 360 kilobyte disk reader, a memory card reader, and soon, a 20 megabyte tape drive.

In addition to the DOS system, which provides continuity with the Micral 30, the Micral 60 runs on Prologue (see our article from last 20 December), and may be configured in clusters of a maximum of 15 systems within the framework of the SPR network, developed for the Micral 90 (which the Micral 60 is to replace).

The choice of Prologue, aside from the fact that it provides continuity for several thousand existing systems, can also be explained by the fact that this software constitutes the only truly operational microcomputer multi-work station system, stated Mr Francis Lorentz, at the introduction of the Micral, during the opening of the MicroBull 2 exposition, saying that "the Micral 60 with Prologue can run one to seven work stations."

"Since Xenix has not yet proved itself as a multi-work station standard," he added, "we have now eliminated this option for the time being, although we have not excluded the possibility of offering Unix for the Micral 60 a few months from now."

The temporary abandonment of the choice of local networks can be explained by the same reasoning: "None of the solutions currently on the market (Ethernet, Starlane or the IBM slot network) has presently been adopted as a standard."

Nevertheless, according to an informed source, up until last week Bull has been having meetings with several OEM suppliers of local networks: of these, 3Com appears to be in the best position.

In contrast, one of the strong points of the 28 January announcement is based on the signing of an agreement between Bull and Microsoft, concerning the co-operative development of software products for connecting local networks (in this case, MS-NET selected especially for the computerization of post offices with Goupil machines), for word processing and graphics interfaces.

Another agreement between Bull and AST was signed calling for Bull to offer some of the products of this American company specializing in peripherals, under the Bull/Micral/AST name: in particular the Rampage extension card which allows the 640 kilobyte limit of the central memory imposed by MS-DOS to be bypassed.

At the manufacturing level, the group is doing its utmost to avoid the delivery delay problems encountered last year with the Micral 30, which have prevented even better commercial performances than those recorded (33,000 machines, 23,000 of which were Micral 30's). The start-up of the new Villeneuve-d'Ascq factory last 2 January, whose manufacturing capacity is two microcomputers per minute, should prevent this type of inconvenience for the manufacturer. It plans to deliver approximately 45,000 to 50,000 microcomputers (last week, due to a typographical error, we stated the figure as 60,000 machines), 20 percent of which should be Micral 60's.

A great effort is being made with regard to other European countries. The Micral 60 should be introduced in Spain, West Germany, Netherlands, Belgium and Austria in March. The manufacturer estimates it is in fifth position in the European market with 3 percent of the market. With 13 percent of the market, it would be second in France.

13146/12712
CSO: 3698/299

METALLURGICAL INDUSTRIES

SWITZERLAND ACHIEVES HIGHEST AMOUNT NITROGEN IN STEEL

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 5 Feb 86 p 5

[Excerpts] By alloying the atmospheric gas nitrogen a new grade of steels is being developed today intended to combine a maximum of strength with a maximum of toughness. The introduction of this unusual alloying element presents considerable difficulties. Using an induction melting process, the Institute for Metallurgy of the Swiss Technical High School (EHT), Zuerich, melted steels with maximum values of four percent nitrogen--some kind of world record in this approach to "hybridize" the raw material iron.

The latest development on the path to steels with utmost strength plus toughness employs an alloying element which in principle acts similarly to carbon: the gas nitrogen. Not only can steels be hardened with nitrogen, but, as with nickel, the austenitic structure can also be stabilized. After initial successes in this application, steel research in this field has now gained momentum internationally. Leading research is being performed at the "Institute for Metal Research and Metallurgy" of the ETH, Zuerich, where they succeeded in producing "maximum nitrogenized" steels having a nitrogen content of up to four percent.

At the ETH Zuerich an approach was sought to achieve highest nitrogen contents which can only be obtained under higher pressures than in the past. In so doing, the solution was found via the principle of an induction furnace where the steel charge in a high-pressure crucible is heated by induction melting. Pressures up to roughly 200 bar were obtained this way.

So far, three of these furnaces were developed with graduated melting amounts, namely for 20 grams, 400 grams and 9 kilograms. The smallest furnace is used primarily to determine the solution ratios of nitrogen in steel, the two larger ones to determine material properties. It is apparent that with the help of the nitrogen alloy the mechanical characteristics of the steel (combination of strength and toughness) are significantly increased.

13011/5915
CSO: 3698/326

MICROELECTRONICS

INNER WORKINGS OF 'MEGAPROJECT,' ITS CURRENT STATUS, AT SIEMENS

Stuttgart BILD DER WISSENSCHAFT in German Nov 85 pp 41-75

[Article by Uli Deker: "The MEGA Chip: Europe Accepts the Challenge: Research, Development and Production at the Same Time"; includes interview with member of the board of directors of Siemens Prof Karl Heinz Beckurts by BILD DER WISSENSCHAFT editor-in-chief Wolfram Hunke; date and place not given; first paragraph is introduction]

[Excerpts] Microelectronics has become the engine of our industrial society. Whoever can produce the most powerful chips can thus also produce the most powerful systems. Europe has largely missed out on this development. Nevertheless, Philips and Siemens have joineed together in a unique cooperative project in order to push forward to world leadership by 1989. The goal: the MEGA chip.

"All of us feel that we are pursuing this project in a different way than has been customary thus far in this technology. Everyone is getting precisely defined assignments, the results of which must be submitted quickly. And people know that further steps depend on their work. The freedom that there used to be in semiconductor labs is a thing of the past." Johann Haserer explains: This is not a wistful farewell to the past, it is the optimistic departure into a new future. Johann Haserer is one of the project leaders of MEGA, responsible for "joint tasks."

MEGA comes from the megabit chip: On a small silicon chip with a surface area of only 0.5 sq cm, room is to created for one million bits--one million zeros or ones. This is four times as much as on the chips presently available, the 256-kilobit memory chips, which came onto the market in 1983. For the last 15 years, the memory capacity of chips has quadrupled every 3 years. A million bits would be enough to store 20 full pages of text from this magazine.

The goal of the Siemens MEGA project is to put the one megabit memory chip on the market by 1986 and to follow suit with the four megabit chip by 1988. This should then be followed by "megalogic." This means logic chips that fulfill more complex functions than simply storing data. If Siemens achieves the set goal, then it will have at least made up for the technological lead of the competition from the United States and Japan. Siemens would be at the forefront in microelectronics and no longer the "sleeping giant." And the same is true for its cooperative partner Philips.

Is it possible, however, to simply plan the development of a leading technology? Why should MEGA achieve something that has not succeeded in previous chip generations, despite increasing efforts? What is special about MEGA?

Johann Haserer points out the window of the Siemens research center in the Neuperlach area of Munich: "The difference from previous projects can be seen if you take a look around here or view the construction site in Regensburg. We are already erecting buildings today for the development and production of a product that we have not even developed yet. Up to now, we have always worked in sequence: The product had to first achieve a certain readiness to go into production before production was taken up."

With MEGA, however, all the forces are to be mobilized and brought together. And this with determination and means that are quite unique in the history of European companies:

--DM 1.7 billion is being alloted for investments, which is a considerable sum even for a company with DM 45 billion in sales.

--MEGA is not assigned to any corporate sector, but rather is subordinate to the board of directors.

--Research, development and production are being conducted parallel to one another.

--The entire project is tightly organized with the "network plan technique," down to the last detail.

--The production know-how for the one megabit memory chip was bought from Japanese competitor Toshiba for an unnamed amount of money.

--For the development of the four megabit chip, Siemens has joined together with its competitor Philips in a cooperative agreement involving intensive exchange of knowledge.

This second stage of the project, called "submicron memory," is being supported by the German Ministry for Research and Technology (DM 300 million) as well as by the Dutch Ministry of Economic Affairs (170 million guilders). Siemens and Philips are splitting the entire sum in half.

The governments are treating the funding not as subsidies, but rather as a contribution to a lowering of risk. And MEGA does represent a risk: If it was possible thus far to follow roads already taken by the competition, now it is necessary to cut a path into new territory. It is uncertain whether it will lead to the goal. In this sense, cooperation offers important support. One's own wrong turns can be evened out by the experiences of the partner.

"We are all taking a greater risk than ever before," Johann Haserer emphasizes. "The decision made by a scientist has direct effects on the entire investment. This was not the case previously, because only the successfully completed research and development projects were converted into a product. Now, however, this is taking place on a parallel basis. A poor procedural step throws the success of the whole thing in question. Look at production equipment: We have to go ahead and specify them, and order them from suppliers before we know exactly what the megachip will look like and how we are going to be able to produce it. One single machine that does not meet the requirements or is ready too late could cost us a gigantic amount of money."

MEGA was adopted unanimously on 6 February 1984 by all 22 board members. Since November 1983, a project group has been working the plans for it.

Externally, MEGA means:

--Concentration of developmental work in the Munich-Neuperlach research center.

--Construction of two development facilities for the one and four megabit chips, each with 2,000 square meters of clean room.

--Construction of production facilities in Regensburg.

--Purchase of equipment for development and for production.

--Employment of more than 100 engineers for development in Neuperlach.

--Creation of 350 jobs for production in Regensburg.

Even on this external level, the problems can be recognized. Hiring personnel, acquiring equipment and building are among the routine tasks of a company. Here, however, top quality in the shortest period of time is called for.

Through technical tricks and especially through perfect optics, it is ideally possible today to reproduce 0.6 micrometer-fine details. This is very little tolerance for the production of the four megabit chip. The greatest demands must be made of the lense system. Zeiss--as an exception to the rule, a European manufacturer--is one of the leaders in the world market for this, which is for Siemens a very favorable basis for negotiation.

"We are trying to win over European manufacturers for all the separate equipment, to the extent that they are competitive with world standards," explains Dr Willy Beinvogl, leader of the four megabit chip project. "The United States dominates in highly-specialized equipment. Japan is quickly catching up. But European firms are also capable of manufacturing such equipment. For example, Balzers in Liechtenstein, Cit-Alcatel in France, ASM in the Netherlands, Electrotech in Great Britain or Leybold Heraeus in the FRG. We are also very much interested in cooperative ties, in which we leave our mark in providing know-how."

Nor is the third point--finding employees--a simple one. What is being sought are people with the highest possible qualifications who can efficiently join the project immediately. If they first have to undergo months of training, then they take more worktime away from available employees than they themselves contribute.

At colleges, however, knowledge of specialized and current microelectronics is imparted only intermittently. Prof Ingolf Ruge, head of the Fraunhoffer Institute for Solid-State Technology (IFT) and professor at the Technical University of Munich, is harsh in his judgement of his colleagues:

"Most of them are simply not willing to keep up, even in teaching, with a technology that is so complicated and that is developing so quickly. People don't want to change their lectures every semester. That would require flexibility, a large store of fundamental knowledge and also the willingness to travel once a year to Japan or the United States. Many of them don't want that, and in our system of technical colleges they don't need to either."

Ruge sees the causes for the poor representation of microelectronics in the colleges in the past as well: "In the 1950s, there was a really excellent silicon technology in Germany. Dr Spenke at Siemens was the worldwide expert for the production of purest silicon. Even today, at least half of the silicon used by American and Japanese chip producers comes from Burghausen von Wacker Chemitronics. But then at some point we missed the connection. And in my opinion, the role played by the student revolt in this is highly underestimated. I myself was meanly slandered because I got research money for the college from industry. This is why I founded the IFT on my own initiative."

Ruge is one of the most crucial initiators of West German microelectronic development. As early as 1980, he propagated a "National Project Megabit Memory," which was to be pursued jointly by the state and big business. In 1982, he travelled with Uwe Thomas, a department head at the Ministry for Research and Technology, to Japan in order to gain first-hand information. What they found exceeded their expectations: Work on four megabit memory was already well under way. For this reason, they recommended that industry join together in a cooperative arrangement on four megabit memory.

Siemens chairman of the board Kaske was immediately receptive to this idea. For Philips the decision was more difficult, because neither Philips in Eindhoven nor its German semiconductor subsidiary, Valvo, had up to then been active in the chip business. The cooperative agreement was signed in the summer of 1984.

One ideal element of this cooperative arrangement is the decision by the two companies to pursue different goals: Siemens is building a so-called dynamic four megabit memory (DRAM), Philips a static one megabit memory (SRAM). Both require approximately the same degree of refinement of structures, and thus largely the same production processes.

For Siemens, the cooperative arrangement with Philips involves only four megabit memory, while MEGA covers one megabit memory and the megalogic that goes along with it.

The central figure in MEGA is the overall project leader, Dr Hans Friedrich. All the threads come together in him; he has only the four-member steering committee to answer to, in which the board of directors is represented by the leaders of the two directly involved sectors, Prof Karl Heinz Beckurts of "ZT" [Central Sector for Research and Technology] and Dr Hermann R. Franz of "B" [Component Parts Sector].

The overall project is subdivided into sections on several levels. Initially, there are seven sections: one megabit, four megabit, megalogic, business management, Munich-Neuperlach facilities, Regensburg facilities and joint responsibilities. They are futher divided into subprojects, study subjects, and eventually some 350 job blocks.

The entire thing is controlled and monitored by a methodology that has proven most worthwhile in large projects in the construction industry: the critical path method. The critical path encompasses all job blocks in their logical and temporal independence from one another. Estimates of the necessary expenditure of labor in the individual tasks permit the setting of an exact deadline. In this way, it is possible to determine in particular the critical job blocks, a delay in which would block the entire project.

The set goals are automatically monitored by the computer, which must be informed of the completion of all tasks. In this way, if too much time is taken, appropriate steps can be initiated.

It sounds here as if one could organize such a project from a bureaucratic ivory tower, and even that all that is necessary is an ingenious computer program. What is crucial, however, is that the project be optimally infused into the existing structures of the company and that the know-how available at various places be mobilized and concentrated. Because competent employees and creative ideas have clearly always been available. They simply have not been harnessed effectively for joint tasks.

"Matrix organization" is the magic word for the solution of this problem: Every employee on the project remains within the framework of the original form of organization, but for the purposes of the project is in addition subject to the project's organization. Besides his normal boss in the "line," he also has a MEGA project leader as a boss.

Through this tight, so to speak two-dimensional organizational structure, Siemens hopes to overcome estrangement from the classical path of development and through simultaneous, parallel work to considerably shorten the time until the product is introduced on the market.

The matrix structure of the project does not apply only to the three outer shells of MEGA, facilities, equipment and personnel. The four inner shells are also tightly interwoven:

--The innermost shell is composed of the basic structures, the physics of components parts and of procedural steps. Using computer simulation in particular, an attempt is being made to predict and analyze the effects of a further scaling down in structure.

--Using this knowledge, the procedural steps must be constructed such that they are suitable for mass production. This includes the optimal association of individual processes with the overall process.

--The circuit must be designed. If one knows what the individual memory cells must look like, then one still has to arrange a million of them on the chip and connect them with the drive logic.

--This can happen only with computer-aided design (CAD). Programs that automatically convert the ready design into codes for mask production must be created.

"With our Venus CAD system, we have in the meantime caught up with the world's leading producers," says Dr Egon Hoerbst, leader of the CAD sector at Siemens. "At any rate, I know of no better system at the moment. We will also be designing megalogic with it. But we can only do so when we know what the logic structures look like in detail."

The connection between the seven MEGA shells extends from the basic principles of physics to computer design, all the way to the manufacturing equipment and production facilities.

An example: Initial ideas of what the memory cell might look like have been developed and have now been realized on test chips. In endurance tests with elevated live voltage, however, defects are appearing. The component parts physicist finds that the transistor is the weak point. Through computer simulation he determines that the field intensities on one side of the so-called "channel" are taking on values that are too high. The result is a sort of short circuit. What to do?

Perhaps the dopant pattern on this side can be rounded off somewhat? The new simulation yields positive results. Now, however, the process technician has to be consulted, since he must decide whether such a pattern can be manufactured.

In this way, intensive communication between physicists, engineers and technicians from very different areas takes place in a detailed problem. It can draw on still other areas if it is, say, discovered that the necessary dopant pattern requires additional characteristics of the ion implanter or even that it is only possible under stricter clean room conditions. Or the problem turns out to be so stubborn that additional coworkers have to be consulted in order to solve it in the allotted period of time.

There are many other examples that could illustrate the matrix structure. What is crucial is that the MEGA team clear a path together into the new territory.

"It is no longer possible to look for the way that is optimal in one's own opinion, one must choose the one that presents itself and which can also be pursued by the others," explains Johann Haserer. "We are therefore doing a lot with shaping consciousness. We are trying to keep everyone up to date on the very latest developments. All the way down to the level of the individual operator, everyone should know what is going on at the moment, where there are difficulties and where there are successes."

Haserer continues: "For example, the MEGA report comes out every other month. We celebrate together whenever there is something to celebrate. Even the board members, Beckurts and Franz, and the overall project leader, Friedrich, are there, and they talk to people. We are already something like a secret society.

"The younger coworkers in particular have reacted very positively to MEGA, even though they are under very heavy pressure--especially time pressure--and are to a certain extent working in shifts, which was never the case in classical research and development."

The feeling that things are breaking open is being followed attentively abroad. The bilateral cooperative arrangement between Siemens and Philips, which is apparently working, was met with incredulous amazement in France in particular: Cooperation at a preliminary stage, as a sign of good will, was conceivable--but cooperation in a product that promises to bring in enormous sales?

The logical step has already been taken from this experience: On 14 June, representatives from industry and science from the FRG and France held talks on a joint "Chip 1995" project within the framework of Eureka: The technology for 64 megabit memory is to be developed by 1995. The German industrial consortium is represented by Eurosil, the Fraunhofer-Gesellschaft, Telefunken, Siemens and Philips subsidiary Valvo.

In view of this project, is MEGA not merely a small burst of action?

By no means. Because four megabit memory probably represents the end of present technology. It will be impossible to produce even the 16 megabit memory chip through optical masking; instead, it will be necessary to apply X-ray lithography or other methods. For electronic and physics-related reasons, this chip will have to have three-dimensional structures--the first signs of this are already necessary for the four megabit memory chip--and it will have different electrical power requirements. This means that the users will not be able to use it like previous memory, but rather will have to develop new circuitry.

Another question is whether it will be possible to deal with, and thus take advantage of, the complexity of the logic circuits that will be offered by 64 megabit technology.

The timing of the spurt of activity by Siemens and Philips thus appears to have been well-chosen. Precisely because of the fact that both companies are only now jumping in with high pressure and new momentum, their chances might be better than those of the competition, accustomed to success. Perhaps there is a reverse "Japan effect" at play here.

Amidst all the euphoria, one should certainly not forget that the competition is enormous and that it is clearly not sleeping. The Japanese are still distinguished by their strong motivation, their selfless attitude towards work and the strong, government-pushed concentration on future technologies. And the Americans by their readiness to take risks, their pioneer spirit, their inclination towards the unconventional, by the strong competition within their own country and the interest of the Department of Defense.

In contrast, German thoroughness is ill-suited for work in this sector, which leaves no room for the search for the ideal solution, but rather permits the survival of only those who find technically and economically feasible solutions as soon as possible and convert them immediately into action.

Professor Ruge is optimistic in this regard: "We have been hesitant, as a land of culture, about making the leap over as a land technology for too long. Now, we are finally daring to do so."

The MEGA Chip: The Physics of Progress

What can be said today about the production technology of the one as well as the four megabit memory chip at Siemens?

The chip will be designed with the help of the Venus CAD system, which is regarded as one of the most efficient systems in the world. It has created automatic data tapes that guide the electron beam as it makes patterns in the chromium layer of the mask.

Defects in the mask would be particularly disastrous, since they would be transmitted to all the chips produced with it. High precision in the masks is also necessary because successively varying structures have to be put on them. A total of 13 or more masks are necessary, which must be made exactly congruent at various stages of production.

So-called wafer steppers are used as exposure equipment. They expose the chips on the wafer in blocks and in this way collimate each block on its own. Only in this way is it possible to achieve on the one hand the necessary congruence precision of 0.1 micrometers and on the other hand the necessary optical definition.

The light-sensitive coating consists of several layers. A thick base layer first levels out the differences in altitude on the chip surface. The depth of field of the object to be reproduced is very low because of extreme dispersal.

The actual photoresist must be very contrast-intensive. It deliniates the relatively unsharp mask image with a particular shade of gray and thus makes possible more sharply contoured structures than those shown by the optical image. It is only in this way that 0.7 micrometer structures can be produced with wavelengths of 0.4 micrometers.

The non-exposed or only poorly exposed parts of the wafer must then be washed off in order to serve as windows for the actual structure.

There are three basic processes to be distinguished here:

1. Production of a new layer:

The key layer in semiconductor technology is insulating silicon dioxide (SiO_2). As a natural oxide of silicon, it can be easily produce through heat treatment in a furnace at approximately 1000 degrees Celsius.

Up to a dozen other layers must be put on the wafer surface. Dominant here are the so-called CVD processes (Chemical Vapor Deposition). They take advantage of the fact that certain chemical reactions take place only on solid surfaces. Silane (SiH_4) for example decomposes on a surface into polychristalline silicon--which is used for resistance in the circuitry--and into hydrogen.

The activation of reactions as a rule requires temperatures of between 800 and 100 degrees Celsius [as published]. A high-frequency electrical field makes a cutoff possible between 300 and 400 degrees Celsius (PCVD, plasma-supported CVD).

2. Removal of a layer:

Among the process technologies, developments in etching technology have been the most rapid in the last 5 years. Chemical baths, as used in the past, are not suitable even for the delicate structures of the 256 kilobit memory chip because they contain too many impurities.

Through gaseous etching, ions are produced in a silent discharge through high voltage--chlorine or fluorine ions, for example. They hit the wafer surface, which functions as a cathode, and combine with material there to form a gaseous product ("reactive ionic corrosion"), which is then pumped out. This method has the added advantage that it has a directed effect, and thus does not hollow out the sides of the chip surface.

3. Doping

The actual active semiconducting areas of the chip must be doped. Boron, phosphorus or arsenic must be introduced into the silicon in a controlled concentration. For a CMOS circuit, the substratum must be doped up to ten times.

Here, ion implantation technology is the most powerful method: The dopants are ionized, accelerated through high voltage and projected onto the wafer surface. There they penetrate--according to energy--into the desired depth. Afterwards, it is necessary to see to it, through temperature treatment, that the dopants are in regular places within the crystal lattice and that potential disturbances in the grid are fixed. The portion of dopant atoms can amount to as much as one percent--or only one-ten thousandth of one percent.

Even if these procedural steps are mastered individually, there is still no guarantee of the success of the overall process. In all, more than 200 steps have to be combined in this. The move to a high temperature at the wrong time could lead to unallowably sharp diffusion in one particular layer. Or imprecision in the individual processes add up particularly unfavorably. It also depends on the optimal utilization of the equipment and time necessary for taking a wafer through the production process.

After assembling all the structures, the wafer is sealed and cut apart. Using automatic testing methods, the good chips are separated from the bad ones. Some of the defective chips can still be "repaired," because additional memory cells are applied from the design stage which can replace defective cells. For this, the appropriate "fuses" must be burned out with a laser.

The last step is then to insert the good chips in plastic or ceramic packages and wire them up. Since users are "adjusted" to a particular type of packaging, this seemingly banal point in the process involves the strictest marginal conditions: the silicon chip must fit into a standardized package, a so-called 18 lead DIL (dual inline package, with two times nine "leads"), which for the one megabit memory chip is 0.3 inches wide, and for the four megabit chip is expected to be 0.4 inches wide.

What counts in the end is the yield, the amount of sellable chips relative to the initial quantity of wafers, and the absolute throughput of wafers. A yield of more than 50 percent must be achieved.

Dr Willy Beinvogl, head of the four megabit project: "Getting the production line in full swing and optimalizing a good yield alone will take about a year. Measured in terms of the realization of the first sample chips, we are at present still just under 2 years behind the leaders on the world market in our own development of the one megabit memory chip. Our goal is to be at most one year behind in coming onto the market, through our cooperative arrangement with Toshiba. And with the four megabit chip we then hope to be among the first."

"I Have No Fear That This Project Will Fail": An Interview With Prof Karl Heinz Beckurts, Member of the Board of Directors of Siemens AG

BILD DER WISSENSCHAFT: The nightmare is still circulating to the effect that the state of innovative achievement by German industry has fallen behind that of the United States and Japan.

Faces darken in particular when the subject is microelectronics. Your company in particular, Professor Beckurts, has for years had to put up with being known as a "sleeping giant."

Now the situation has reversed itself: With the MEGA project, Siemens has accepted the challenge and pushed open the door to the future.

Beckerts: Siemens is affected by microelectronics is two ways. On the one hand, we are a major consumer of microelectronic products, while at the same time we are manufacturers of them. Siemens is a so-called systems firm, a world leader in the sector of communications, information and industrial automation technology. And we are increasingly seeing the trend of the chip gaining in importance within the system and more and more entire systems components being realized on a silicon basis.

This is why we must thoroughly master microelectronics, in order to be able to microelectronically produce a large part of our systems in the future.

BDW: And the MEGA program...

Beckurts: ...is to expand our technological basis such that we can maintain our leading position as systems manufacturers in the future as well.

BDW: Do you want to lead the world as a producer of MEGA chips as well...

Beckurts: ...we want to significantly strengthen our position.

BDW: Siemens is among Europe's sales giants. And for the development of the MEGA program, you have joined up with another giant: Philips. Was this technological marriage born of fear or of necessity?

Beckurts: In technical and scientific developments, these cooperative arrangements will soon be the rule in the preliminary stages of competition, and this basically with the goal of lowering costs.

Reduced to a common denominator: Competitors join together in order to achieve things together that they have to do anyway--but under more favorable financial conditions. In the United States as well, cooperation with leading semiconductor firms has in the meantime become quite common. We have also been joined with Japanese firms in a cooperative arrangement for a long time...

BDW: ...but really only recently...

Beckerts: No, but what you are alluding to is the fact that we did in fact reach an agreement a few weeks ago with Toshiba which very much affects activities in the area of the MEGA program.

BDW: The MEGA program means not only billions of marks in investments, but in fact a new way of research.

You had to--and that is original--develop new research structures, you had to build new laboratories and significantly alter communications and personnel structures. Physicists, technicians and engineers had to be hired by the hundreds--all in all a mammoth entrepreneurial program.

What was actually your motivation in pursuing such a large entrepreneurial adventure?

Beckurts: It is not an adventure, Mr Hunke. It is indeed an usually large program, which you must certainly view in perspective. There are clearly other development programs at Siemens that attain this scale. In the end, the entrepreneurial need to support our position as a leading systems firm on the world market led to the decision by the board of directors to carry out the MEGA program. After all, we have not jumped into this program headfirst with no preparation; we have been active in the microelectronics sector for nearly 20 years.

As far as logical microelectronic circuits in particular are concerned, we are still the biggest and most successful European producer. We have for some time produced 64 kilobit memory, and we are just now putting our 256 kilobit memory into production at our Villach plant. With our bipolar circuitry technology, which we use in our calculators, we maintain a recognized leading position on the world market. This is also true for our so-called Tele-Com components and for our Venus design system.

BDW: The MEGA program looks to me like the Manhattan Project, in which there was also a concentration of top scientific personnel in order to realize a specific project within a clearly defined period of time.

You too are following completely new roads in the MEGA program: Development and creation of the production facilities is taking place on a more or less parallel basis. The classic sequence of individual steps--plan, develop, produce--is being superseded by a new network of parallelism.

Beckurts: Well, the Manhattan Project was of a different nature and was--using return calculations--two times greater in magnitude.

BDW: I was thinking mostly about the concentration of intellectual forces...

Beckerts: You're right: MEGA is a complex and an extremely structured research program that is under pressure. And this pressure can really only be compensated for by very precise planning and parallel structures.

BDW: A model for the future?

Beckerts: This process will to an increasing extent become a characteristic of industrial development, because the pace of innovation on the whole has increased so rapidly that the concept of "time is money" has gained a considerable amount of meaning. This is why all development programs aim to win time.

BDW: Professor Beckurts, do you not from time to time have secret fears that the project might fail?

Beckurts: I have no fear that this project will fail. It cannot and it will not fail. But there is no doubt that we are running a deadline risk. Whether we will have the four megabit memory chip on the market by 1989--this is indeed a question that is of concern to me and my coworkers.

So, the risk is not in the development, but rather in keeping the deadline.

BDW: Once again on the new development structures, which will decisively characterize industrial research in the coming years: The new labor system will in fact also require new structures of thinking for physicists, information specialists and engineers since the focus will be on interdisciplinary work in particular. Add to this the fact that the continual timekeeping exerted on workers by the computer exerts immense psychological pressure.

Beckurts: First of all, there are two large sectors working together here, the Corporate Sector for Component Parts and the Central Sector for Research and Technology. For optimal coordination, we have set up project management that acts beyond the limits of these sectors.

We are using management methods that have previously been applied successfully in space technology and in other large projects, and which we have already tried out in recent years.

In this, we are pursuing the achievement of specific interim team goals; there is no timekeeping of the individual workers being carried out by the computer.

BDW: How are the workers in your company accepting this?

Beckurts: It is good in every respect. These methods help workers to better recognize, understand and assess the significance of their individual tasks within the overall project.

BDW: Where are you getting the many new workers?

Beckurts: In the past 2 years, we have hired 600 new scientists and technicians in the Central Sector for Research and Technology...

BDW: ...Siemens as a big customer for German technical school graduates...

Beckurts: As a matter of fact, around one-fourth of the electronics majors graduating from German colleges in the last few years have been hired by the company. Many of them come because for many years we have cultivated intensive personal relations with the places of training and the academic chairs.

Cooperation between Siemens and colleges has greatly intensified in recent years, and through personal contacts it is easier for us to recruit new workers in research and development.

BDW: The cooperative arrangement between you and the colleges has undergone significant intensification over the past few years...

Beckurts: Cooperation has been improved significantly. We have started several programs, especially at colleges located in towns where Siemens has a main office: in Erlangen, Munich and Berlin we have concluded cooperative agreements. They are designed to support so-called special research units, which are research projects chosen jointly by the college and us. We hope that through this we can appropriately support top-notch researchers.

Another example of a major cooperative program is the so-called EIS project (Development of Integrated Circuits), in which a total of 10 colleges are currently involved. It is supported by the Ministry for Research and Technology and coordinated by the Association for Mathematics and Data Processing (GMD) in Birlinghoven.

Within the framework of this EIS project, seven Siemens computers have been installed at colleges in the first phase, and 10 more computers are to follow in the coming period, in order to be available for the training of design specialists.

BDW: Can it be hoped for the future that there will soon be an end to the distance from practical application in student training that is continually lamented by industry?

Beckurts: There is clearly a greater tendency today in the direction of more cooperation. The colleges have changed their attitude, and they are approaching industry. Still, we have a long way to go to get to a situation like the one in the United States.

BDW: At any rate, the fear of contact between colleges and industry which arose during the era of student unrest is receding...

Beckurts: ...it is clearly receding.

BDW: The federal government apparently has a high assessment of your MEGA project. Through 1989, it will be investing DM 300 million. This again fuels the question of whether direct support for research, which was indeed favored by the previous government and which has been described as less effective by the current one--at least since Minister Riesenhuber has taken office--is the right way to pursue an optimal research policy. What would you rather have: indirect of direct research support?

Beckurts: First of all on your figures: Negotiations are still going on concerning the amount of support for the MEGA project from the Ministry for Research and Technology, and Siemens' share has not yet been specified; it could be well under DM 300 million. A figure such as this must at any rate be viewed in relation to our own efforts in research and development.

During the course of the MEGA project, from 1985 to 1989, Siemens expects to allocate more than DM 20 billion to R&D; in this fiscal year alone it will be around DM 4.5 billion, that's about 10 percent of the amount allocated by German industry. With expenditures at this level, we are number three in the world, and the top company in Europe.

In fact, direct support for research from the Ministry for Research and Technology amounted in the last fiscal year to only around six percent of our own expenditures on R&D. In relation to the indirect support of many medium-sized companies, this is in no sense a disproportionately large amount.

BDW: Those are impressive figures, and yet direct support for research in certain projects is...

Beckurts: ...for this MEGA project, for example...

BDW: ...obviously better.

Beckurts: For certain large-scale projects in space technology, in information technology, in biotechnology, in energy technology, and so one at any rate.

This is a legitimate way because it is verifiable and it enables the state to pursue a long-term research policy. However, this apparatus is not sufficient, but rather has to be complemented by indirect support for research--in particular through tax-related measures. And in this respect, things in the FRG could certainly stand some improvement.

Moreover, the state can have a decisive influence on development by making large investments in innovate public projects--in, say, a new communications or express transportation system.

BDW: The criticism is now being heard that the activities of many firms are not coordinated to a sufficient degree, especially when one considers the extent to which German industry must assert itself against competition from Japan. The Japanese have the MITI, the Ministry for International Trade and Industry, for the coordination of their innovative activities, which to a decisive extent coordinates the developmental projects of companies.

Professor Beckurts, could you imagine us having better coordination in research and development projects for German industry through a sort of ministry of industry?

Beckurts: I don't think that a ministry such as MITI is conceivable for the FRG. We have a different understanding of the roles of state and industry. Cooperation between state and business under the leadership of a ministry based on the MITI model cannot work in our free enterprise system. I do not wish to exclude through this the possibility that many activities could be better managed than is the case today.

BDW: How is our research policy different from the research policy of Japan?

Beckurts: I see essentially four areas of state technology policy:

--Innovative public procurement projects, say in the area of communication and of transportation, can correct a market drain.

--The second complex concerns safeguarding a high-quality scientific and technological infrastructure. This means that the state must see to it that a country like the FRG has at its disposal sufficient and effective public educational and research institutes.

--The third complex concerns optimal general conditions for the market. This includes support for innovation through indirect measures. One major problem is presented by the segmentation of European markets. We need a unified market for Europe, which must include unified technical standards.

--Finally, the fourth component is the planned research support for individual focal technologies, especially in those places where there are strong international competitive strains.

BDW: But there are indeed a lot of European research plans: Jet in Culham, ENRC in Geneva and not least of all Esprit. Is not Esprit, which does in fact deal with microelectronics, a contrast to the MEGA program...

Beckurts: Esprit is divided into so many small projects that it cannot compete with with large national programs like the MEGA program. However, Esprit has in many ways promoted development in Europe.

BDW: Siemens is pursuing major technological programs--factory of the future, office of the future, network of the future; programs that will change our society to a decisive extent.

If we go on the assumption that technical progress must be accepted because of its momentum, then the question remains: Are the social structures of our society ready to integrate these new technologies?

Beckurts: I do not think that these developments will overlook society. They are being controlled by way of the market, and the market is an expression of the will of the citizenry.

BDW: But the market for "personal computers" has indeed suffered a decisive setback...

Beckurts: This is not true of the PC in general, but of the "home computer" market in the United States. And this development is more of a sign of the management of that market. The Germans have always been more cautious with home computers--for example, Siemens has never been interested in this area. On the other hand, we are of the opinion that the personal computer--that is, the personal computer for the workplace of the specialist or of the skilled worker--has a very good future, and we are about to enter into this market...

BDW: And social change...

Beckurts: I think that the pace of this change is being overestimated considerably. Developments go step by step and not in gigantic leaps, as it is often depicted in the media, so that there is always time for processes of feedback and adaptation.

We must simply--and this is our responsibility--present the equipment in such a form that it is accepted by the people. On the other hand, we must train people and make them familiar with the new technologies so that they can then interact with it in a meaningful way. Admittedly, testing new technologies on the market entails certain risks--but that is, after all, quite natural.

Again and again, some things appear on the market--such is its nature--that are accepted, while others are rejected. In short, "bad" technology will be unsuccessful and "good" technology will be accepted.

BDW: But of course the public is still concerned about the issue of what effects the new technologies will have on our employment structures.

Beckurts: I refer to the recently published Meta study by the Ministry for Research and Technology. It states that there can be no talk of a strong influence on the number of jobs. There are certainly effects that result in the elimination of jobs, but there are also effects that create new jobs.

If you take a look around in Germany, you will see that job gains are taking place in those areas that are applying high tech and are thus able to increase productivity. And that the losses in jobs are to be found in those areas where little high tech is being brought to bear.

BDW: Would you agree with my theory that the industrial society that we have built since the Second World War was characterized by large projects and by large units, and that the information and communications society will be characterized by decentralization and small units?

Beckurts: I believe that decentralization and small units will definitely play a major role in the future development of our economy. Look at the United States. There, 20 million jobs have emerged in the last few years, predominantly in small companies, with very strong growth in the service sector, but also in the production sector--not, by the way, always intiated by high tech.

BDW: So E. F. Schuhmacher was right: Small is beautiful.

Beckurts: Yes, but "big is necessary." Even chips need electricity, and that is best supplied by large power plants. Our future lies in the symbiosis of information technology and classical technologies, and that amounts to harmonious cooperation between centralized large technologies and decentralized units.

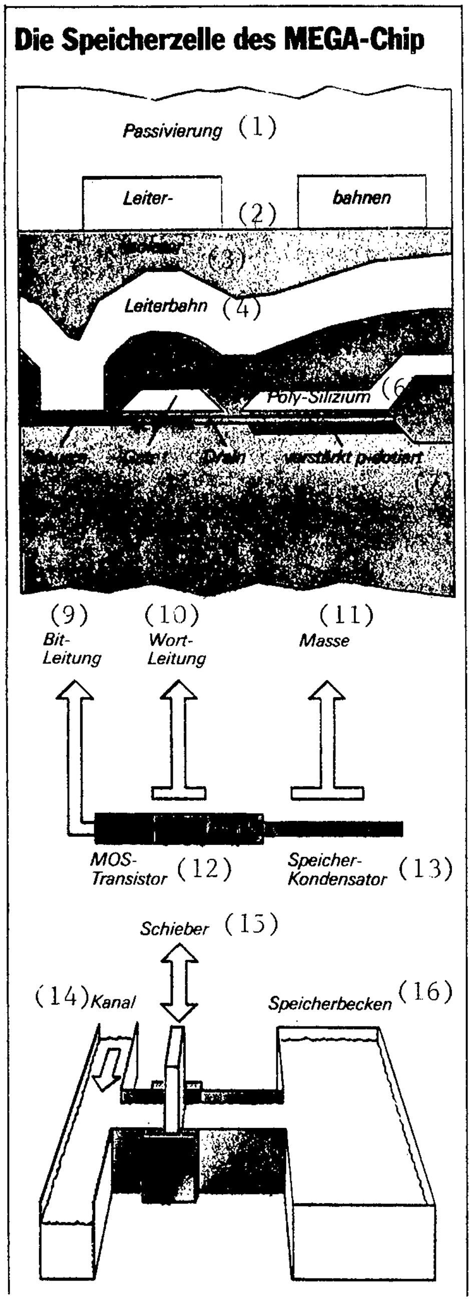
PHOTO CAPTIONS

1. p 42. The design plan for a circuit consisting of millions of operating elements can only be created with the help of a computer screen. The Venus CAD system by Siemens takes the design engineer in stages from the overall architecture to the transposition into individual transistors, capacitors or resistances on the silicon surface and eventually automatically creates the data tapes which control the electron beam as it produces masks.

2. p 67. The memory cell (figure 1) appears to be complicated in construction: sections of silicon with different dopings, conductors and layers of insulation are interconnected. The functional components among them become clear in the diagram: a MOST and a capacitor. Electricity flows between the N-doped

sections of the transistor--source and drain--only when a conducting electron stratum is induced in the P-doped section by positive gate voltage. The word conductor thus determines whether the transistor is open or not--illustrated by the control plate in the channel model in the diagram. If the current is allowed to flow from the bit conductor via the open transistor to the capacitor, then the latter becomes charged and it stores this charge once the transistor is closed. However, the "storage reservoir" is not perfectly airtight. Thus, the charge in a "dynamic" memory cell must always be refreshed.

Figure 1. The Memory Cell of the MEGA Chip



Key:
1. Passive layer
2. Conductors
3. Insulator
4. Conductor
5. Insulator
6. Polysilicon
7. Substantially P-doped
8. P-silicon
9. Bit conductor
10. Word conductor
11. Mass
12. MOST
13. Memory capacitor
14. Channel
15. Control plate
16. Storage reservoir

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CSO: 3698/262

MICROELECTRONICS

NETHERLANDS FOUNDS ADVANCED LASER LAB

Rijswijk PT/AKTUELL in Dutch 15 Jan 86 p 3

[Article: "New Laboratory for Advanced Laser Techniques"]

[Text] Wageningen this week saw the opening of a laboratory for advanced laser techniques established by the Agricultural University in that city. The laboratory is expected to provide important results in environmental research in particular.

The laser research in Wageningen has come about from cooperation between the Agricultural University's Natural Sciences and Meteorology Group and the Catholic University of Nijmegen's Atomic and Molecular Physics Department, supported by subsidies from the Technical Sciences Foundation among others. The new laboratory in Wageningen will now have two installations with lasers operational for various experiments.

One of the most important techniques that the Agricultural University wants to develop further is photoacoustical spectroscopy. This involves directing a beam of light at a sample of gas. The gas absorbs energy from the light and releases it in the form of heat. If the laser beam is regularly interrupted, the heat released causes the gas to expand regularly, which creates small pressure waves. These are actually very faint sounds that can be picked up with a microphone.

Now if there is some ammonia, for instance, in the air sample, then by carefully adjusting the laser frequency and using a very sensitive microphone, it is possible to measure a signal that indicates the concentration of ammonia in the air sample. This is only possible with the very concentrated and homogeneous light of a laser. It is also possible to have the sample (polluted air, for instance) move through the test field continuously and take continuous measurements. Besides these photoacoustical experiments, the Natural Sciences and Meteorology Group is also doing experiments with a technique requiring two lasers to be aimed at one another at a right angle. This makes it possible to measure materials both in the air and in the water on the basis of the change in the refraction index. There are applications for these measuring techniques in a wide variety of fields.

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CSO: 3698/303

MICROELECTRONICS

NETHERLANDS FUNDS INCREASED MICROELECTRONICS TRAINING

Rotterdam NRC HANDELSBLAD in Dutch 4 Feb 86 p 16

[Article by Eefke Smit: "Chip Centers"]

[Text] The three technical universities were allowed to think over for themselves how they could divide up the 132 million guilders to be spent to strengthen research and teaching in microelectronics. The three institutions' joint advice to the minister would not surprise any psychologist: each TH [technical university] should get roughly the same amount.

It may have been equally predictable that the minister of education and sciences would not apply that share-and-share-alike division. His colleague, the minister of economic affairs, who is supplying 2/3 of the amount but is not dividing it up, had quickly made it known after the advice was published that if it was going to be done like that, then he would not provide the money at all. He demanded a clear division of labor and the formation of a national center of excellence.

His reasoning was clear: this financial aid was supposed to eliminate yet another area of technological backwardness in the Netherlands and earn the Netherlands a leading place in the world rankings. To do that you are better off giving one institution a real boost rather than giving all three a small one. Furthermore, microelectronics equipment is expensive. Take it or leave it therefore.

Now the choice has fallen on the Delft TH, where a national chip center is to be established with the sum of 57 million guilders. This Delft Institute of Microelectronics (DIME) will carry out a wide range of activities. That work will "certainly make this a world class Institute," says Delft Professor S. Middelhoek.

Enough was left over to give each of the other two TH's a little center of excellence. At the Twente TH work will concentrate on the area of sensors and actuators, for which 13 million guilders has been earmarked. Eindhoven will concentrate on optoelectronics or the development of gallium arsenide (GaAs) as a new material for chips. Eindhoven is the worst provided for with 10 million guilders and (consequently?) is crying the loudest. According to a spokesman the institution needs at least twice that amount to approach "world class."

Twente is not disappointed with the appropriation of 13 million guilders. Earlier rumors had it that there would be less money than that, and by comparison "things turned out great," in the words of a Twente administrator. They even see the appropriation as "recognition of current work." The fact is that Twente does have a good reputation internationally for its research results with sensors and actuators. And now that activity has been elevated to a national center of excellence.

The field of optoelectronics that Eindhoven was assigned is still in its infancy in the Netherlands. Furthermore, the Eindhoven TH is said to lack a sound plan to develop it. In Delft they predict that it "will be a good couple of years before the Eindhoven TH has become a world class organization in optoelectronics."

World Class

The much-used term "world class" is indicative of how ambitious the plans are. The fact that the activities are being concentrated for this purpose and no longer scattered among various TH's must be welcome to every right-thinking Netherlander.

The question though is whether the 132 million guilders is enough. When you think that industry is investing billions to keep its own microelectronics laboratories up to date, then this appropriation is a small sum. There are scientists who sigh that if you want to be able to do pioneering research, they you cannot be at a university. The appropriation of the 132 million guilders--of which the TH's will have to pay 35 million themselves--will not eliminate those sighs. Not even now that distributive justice has given way to the making of choices.

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MICROELECTRONICS

ALCATEL BOOSTS INVESTED CAPITAL, DIVIDENDS 'UNCERTAIN'

Paris LA TRIBUNE DE L'ECONOMIE in French 25-26 Jan 86 p 1

[Text] "The outlook for Alcatel in terms of profits is uncertain at the present time," said Mr Pebereau, president of Alcatel. He hopes it will be better 1 year from now. Also, to boost capital, Alcatel has decided to issue convertible bonds (Footnote 1) (Issue price: 1,500 francs; face rate 7.75 percent; one for one conversion; amount issued: 900 million francs) with an amortization clause advanced at the discretion of the issuer. (Footnote 2) (Instead of borrowing by scrip certification). The clause clearly demonstrates what the management hopes for: a rapid increase in profits. For 1985, profits were estimated to be 200 million francs, or 96.9 francs per non watered share.

It should be noted that, because of a loss of 1 billion francs by LTT, Alcatel will not be required to pay taxes for at least 3 years. The CGE-ATT agreement has not yet been finalized and the conditions of competition and partnership regarding telephones are still undecided. Alcatel's goal is ambitious: Revenue, which was 400 million francs in 1968, reached 28 billion francs in 1985, and the goal of the company is to bring this figure to 50 billion francs in 1990. Alcatel is fifth in the world in public telephones and sixth in private telephones, according to the president of the group.

For the rest of the CGE group, president Pebereau stated that the consolidated sales figures from 1985 showed an increase of approximately 7 percent, and orders will be markedly higher, due primarily to foreign orders. CGE is also pursuing its industrial investment outlay, which reached 3.4 billion francs in 1985 and will increase to 3.9 billion francs in 1986.

Reasearch and development increased to 4.9 billion francs in 1985 (+ 14 percent) and a total of 5.6 billion francs is planned for 1986. The CGE group plans to list CGEE Alsthom or Cables de Lyon on the stock exchange 1 year from now.

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MICROELECTRONICS

BRIEFS

NEW GROUP 'ALCATEL' FORMED--A special general meeting of CIT-Alcatel, which took place last 31 December, approved the takeover of Thomson Telecommunications, effective retroactively to July 1985. The group will henceforth be known as Alcatel. The meeting also approved the transfer to CIT-Alcatel of Thomson-CSF Telephone's public switching division and LTT's transmission equipment branch. The private telephone activities of Thomson-CSF Telephone were incorporated into a subsidiary, and the cable branch of LTT has been transferred to Cables de Lyon. [Text] [Paris ELECTRONIQUE ACTUALITES in French 10 Jan 86 p 6] 13146/12948

OLIVETTI-SEIKO LIQUID CRYSTAL DISPLAYS--Olivetti has just entered into partnership with the Japanese electronics firm Seiko Instruments on the basis of an equal partnership (50-50 percent), with the goal of producing flat liquid crystal display screens. The new company, known as Tecdis, implements techniques developed by the Japanese manufacturer although, according to the terms of the agreement, it will have its production and operations based in Italy. These flat screens will then be marketed throughout Europe. This display technique, which uses very little electricity, is of extreme interest for use in portable microcomputers--the M-10 made by the Italian company is so equipped--and it may also be used in other types of equipment, such as automobiles. This agreement confirms Olivetti's drive to pursue its "technological vigilance" policy. Seiko, by virtue of its Epson subsidiary, is one of the two largest manufacturers of liquid crystal display screens in the world. [Text] [Paris ELECTRONIQUE ACTUALITES in French 10 Jan 86 p 7] 13146/12948

PHILIPS ESPRIT PROJECT--The EEC's ESPRIT [European Strategic Program for R&D in Information Technologies] program includes a BICMOS project [joining] CMOS and bipolar technologies for which Philips is the prime contractor and in which Siemens and the universities of Dublin and Stuttgart collaborate. The project aims to reach the limits of BICMOS technology. Market specialists disagree on the potential of these hybrid integrated circuits, but in the telecommunications equipment market alone, multiple applications are conceivable. [Excerpt] [Brussels LA SEMAINE INFORMATIQUE in French 14 Mar 86 p 17] 25004/9365

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SCIENTIFIC AND INDUSTRIAL POLICY

FRG OFFICIALS ON ROLE IN SDI, EUREKA, 'TECHNOLOGICAL EUROPE'

Duesseldorf VDI NACHRICHTEN in German 27 Dec 85 p 3

[Text] The American research program SDI and the European Eureka Program drafted as a countermove have heavily influenced scientific and political discussion in the Federal Republic of Germany over the past year. The EEC Commission in Brussels has finally initiated another "Technological Europe" plan. Linked to all of these concepts are hopes that technology will experience a spurt of growth on the eve of the 21th century.

1985 was a year of technological, scientific and political decisions which will have a critical influence on the directions taken by research in the Federal Republic of Germany and in Europe as a whole, for the coming decade at least.

Three important developments were decisive: First, there was the West German government's decision in principle, made during the last week before Christmas, to participate in the American SDI (Strategic Defense Initiative) project. Second, at the beginning of November, there was the strengthening, once again, of the decision by 17 European nations to breathe life into the Eureka (European Research Coordination Agency) project. Finally, there was the plan formulated at the end of November by the Twelve nations of the European Economic Community, to create a European domestic market beginning January 1, 1986, and, parallel to this, a "Technological Europe."

The diversity of this research and technology policy, which, superficially at least, seems to have little homogeneity, is puzzeling and confusing. However, behind all three concepts, the translatlantic project (SDI) and both European ones (Eureka and "technological Europe") are general political appraisals of the world's technological development and the role of the Federal Republic of Germany and Europe in this process.

Bavarian Prime Minister Franz Josef Strauss and the EEC commissioner in charge of research and new technoligies in Brussels, Karl-Heinz Narjes, represent both ends of the spectrum in terms of their appraisal of this situation. Strauss, who has advocated SDI from the beginning, believes that the $60 billion which the American government has set aside for SDI will usher in an era of tremendous technical progress. Failure of the West German government to participate, he feels, would be tantamount to scientific and political suicide.

Narjes, as a representative of the EEC, thinks otherwise. For him, favoring SDI means abandoning Europe as a technological community, and this at a time when such a community is just beginning to take shape. Narjes also sees the Eureka Project, with its headquarters in Strassburg, as a dangerous splintering of European research efforts.

There is one thing which the positions defended by Strauss and Narjes have in common, however: both are based on the threat to the economic competitiveness of the Federal Republic of Germany and Europe as a whole which comes out of the American and Japanese challenge--with these two countries probably soon to be followed by the Taiwanese and the Koreans, as well. Both the proponents of SDI and those of the European project want to meet this challenge. Where they differ is in how this should be done.

What is behind SDI, Eureka and the "technological Europe" plan? In terms of SDI: With their Strategic Defense Initiative, the Americans want to have by the mid 1990's a laser weapon system stationed in space, capable of destroying any intercontinental rocket immediately after takeoff. Such a system would require substantial innovations not only in laser development, but also in computer technology: experts estimate that in the event of a nuclear conflict, at least 10,000 Soviet atomic warheads would be launched at the U.S., along with nearly 100,000 dummy warheads. Computers would have to be able to determine which should be shot down. Critics doubt the technical feasibility of such a plan and warn that the arms race may be intensified as a result of SDI.

The West German government, especially Chancellor Kohl, has always emphasized that it only wanted to participate in the research end of the SDI program, not the practical implementation of the system. And the American government's $60 billion were enough of a guarantee that something would come of the project.

With regard to the Eureka Project: Despite all protestations to the contrary by German and French politicians, Eureka was a reaction to SDI. The brainchild of current French Prime Minister Laurent Fabius and German Foreign Minister Hans Dietrich Genscher, the project was outlined in initial proposals which showed an embarrasing similarity, in terms of content, to the SDI research plans. There was one important difference, of course: in the Eureka project the emphasis was on civilian applications from the very beginning, in contrast to the predominantly military goals of SDI. Ten projects have been adopted so far by the 17 nations participating in Eureka. 1. European standard for microcomputers. 2. Development of a vector computer. 3. Production of amorphous silicon. 4. Development of a robot for textile manufacture. 5. Development of membranous filters. 6. Development of a high-performance laser. 7. Program for measuring the occurrence and radioactivity of environmentally significant trace elements throughout Europe. 8. European research network. 9. Diagnostic system for diseases communicable through sexual contact. 10. Flexible production system based on optical signals.

The Eureka project has found its staunchest supporter in Federal Research Minister Heinz Riesenhuber: "What the Eureka project is intended to provide is, on the one hand, a unified market in Europe, and on the other, improved living conditions for the people of Europe. These two goals are inseparable. Eureka should create a governmental framework within which individual initiative can develop, but where the government does not hand down edicts." Eureka would be organized so that partners with matching interests would work together on specific projects. The organization as a whole would be directed by a small, flexible, unbureaucratic secretariat in Strassburg. Says Riesenhuber: "The government will not be luring companies with subsidies. However, in individual cases checks will be made to determine whether subsidiaries can be assisted financially." Obviously there is no comparison here with the $60 billion in subsidies provided by the U.S. government to spur technological advances. Instead, the project will rely on the ability of the European scientific and research communities to do their own organizing.

Finally, there is the "technological Europe" plan. This initiative is supported by the member governments of the European Economic Community, and especially by the president of the EEC Commission, Jacques Delors. Here again, the intention is to try to unify the European domestic market, especially in the areas of new technologies, norms, standards, and the expansion of joint research through existing programs. The first handicap, however, is the sluggishness of the bureaucratic headquarters in Brussels. The second handicap: no money. Every year the EEC manages to steer clear of bankruptcy by subsidizing agriculture. In 1984, the EEC budget had over 38 billion ecus (1 ecu = 2.21 DM) allotted for payments and liabilities under its farm policy, as opposed to only 1.3 billion ecus for research. With this kind of background, the "technological Europe" project does not give much cause for hope.

The debate on SDI and Eureka is not over yet, however, either in the FRG or in Europe as a whole. The French have refused any participation in SDI, while the British have been the first European nation to conclude a skeleton agreement with the Americans toward joint work on the project; significantly, this agreement was signed by the defense ministers of both countries. Moreover, the decision by the West German government to participate in the SDI project was based only secondarily on scientific, technical and political factors, and was brought about primarily by national security considerations and the desire to maintain political alliances. This was recently emphasized once again by Chancellor Kohl.

There are doubts about both SDI and Eureka in the Federal Republic of Germany as well. The president of the DIHT (German Industry and Trade Commission), Otto Wolff von Amerongen, warned against excessive hopes that participation in SDI will prove to be a cure-all for the economy, but also against a return to "subsidy-ism" as a result of the Eureka program. He also pointed out the largely identical requirements of Eureka and the EEC initiative for a "technological Europe," and the associated risk of awarding duplicate grants. Similar reservations have been voiced both by industry and by the scientific community. For example, the Federal Association of German Industries would only comment that Eureka "could be of use" to European research and industry. SKI, Eureka, and the "technological Europe" project will be taking more definite shape over the next few years. Whatever the final form of these programs, they will be determining the main directions taken by science, research and industry for the next decade.

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SCIENTIFIC AND INDUSTRIAL POLICY

INCOME TAX COMPUTATION FOR VARIOUS TYPES OF FIRMS IN FRG

Duesseldorf VDI NACHRICHTEN in German 27 Dec 85 p 29

[Article by H.-J. Zwingmann: "Taxes - A Science Unto Itself"]

[Text] With the start-up of a new company, technical officers are faced with complex tax material. Aside from income tax, the corporation tax, revenue tax and trade tax also play a decisive role. I hope that the following illustrated article will help to shed light on this obscure material.

Individuals are subject to full income-tax liability, if they reside within the country, or if their ordinary place of abode is within the country. The Internal Revenue Code distinguishes between seven different income categories:

1. Income derived from agriculture and forestry.

2. Income derived from trade.

3. Income derived from self-employment.

4. Income derived from employment (dependent personal service).

5. Income derived from shares and securities.

6. Income derived from rentals and leases.

7. Other income.

Income from agriculture and forestry, trade, and self-employment are determined by profit (=classes of profit income). Two essential means of profit determination are the business assets comparison, as defined in section 5 Internal Revenue Code, and the surplus receipts account, as defined in section 4, paragraph 3 Internal Revenue Code. The rendering of a balance sheet + income statement is known as double-entry bookkeeping (business assets comparison). The juxtaposition of earnings and expenses is known as single-entry bookkeeping (surplus receipts account).

The surplus receipts account, which can always be kept by the self-employed, regardless of the amount of revenues and profits, is of particular importance to a planned start-up of a new company. Here profit is defined as the surplus of operating earnings over operating expenses, in which regulations concerning deductions must also be taken into account. The surplus receipts account can also be prepared by the small businessman (revenues up to 360,000DM, business assets up to 100,000DM, and profit from trade up to 36,000DM). Should a criterium be exceeded, in general, you would be liable to compulsory bookkeeping, and, therefore, required to prepare a balance sheet and income statement.

Under the other four income classes, income is the excess of receipts over professional expenses (=classes of surplus income). If, for example, you have positive (=profit) earnings from self-employment in the amount of 50,000DM and negative (=losses) earnings from trade in the amount of 10,000DM, then your total earning would equal 40,000DM.

After deducting special allowances, extraordinary expenses and other allowances, taxable income remains. With a maximum taxable income of 4265 DM (single)/ or 8531DM (married), the income tax debt would be 0DM. Once this limit has been passed, the proportional taxation bracket, with an income tax of 22 percent, begins. Proportional taxation ends with a taxable income of 18,000DM (single)/ or 36,000DM (married). After exceeding this limit, the progressive rate scale applies, where an income tax of up to 56 percent is levied.

Corporate bodies, such as limited liability companies, stock corporations, and cooperatives are subject to corporation taxes if their management or headquarters are located within the country. The Income-and-Corporation-Tax Law serves as the basis to ascertain income. Taxable income is subject to a corporation tax of 56 percent; if profits are distributed to corporate members, the rate drops to 36 percent. For example: the engineering limited liability company X shows a profit of 500,000DM. Mr Z, too, is a corporate member with a share of 20 percent. The profits are to be distributed. Mr Z's profit share is approximately 100,000DM. After deducting the 36 percent corporation tax (36,000), 64,000DM remains.

The limited liability company must withhold a capital yields tax of 25 percent (16,000DM) from the 64,000DM, leaving Mr Z with a net amount of 48,000DM. When filling out his income tax, Mr Z reports this income as income from shares and securities. With an assigned income tax rate of 35 percent Mr Z would be required to pay an income tax of 35,000DM given a profit share of 100,000DM. However, since the limited liability company has already paid 52,000DM (corporation and capital yields taxes) to Internal Revenue, Mr Z receives a refund of 17,000DM. Consequently, the amount of the income tax on the limited liability company's profit share is dependent upon the personal circumstances of corporate member Z.

According to the Revenue Tax Law, the businessman is defined as a person who independently performs a trade or business activity. The business encompasses the entire trade or business activity of the businessman. Trade or business is any ongoing activity carried on to earn income, even if no profit motive exists, or if an association takes action only with respect to its members. According to the Revenue Tax Law, the businessman is required to keep records that will service to determine the tax and the basis of its assessment, from which, for example, collected renumeration for deliveries made, and other services rendered by the businessman, must be evident. Here, payments are categorized according to tax rates, or taxable and tax-exempt revenues. In general, a tax rate of 14 percent applies to revenue tax. In many cases (for example, for books and magazines), a reduced tax of 7 percent is also applied. Important for technical officers who wish to become self-employed, first as freelancers: revenues up to 20,000DM net per year are exempt from revenue tax.

Of course, then you cannot give account of any revenue taxes on statements. However, you may also opt to pay the revenue tax and you are then bound to this option for five years (choice of taxation observance). In general, this option should be used first when the input tax is refunded--that is, the revenue taxes charged to you for deliveries or services rendered--and second, when you can deduct, up to a revenue of 20,500DM, 80 percent of the revenue taxes payable to you as a tax deduction. You can take advantage of a graduated tax deduction up to a revenue of 60,000DM, which is decreased by 1 percent for each additional 500DM of revenue. For example: revenue: 20,900DM = 79 percent deduction, revenue 43,700DM = 33 percent reduction, revenue 59,600DM = 1 percent deduction.

In individual cases, as a part-time, self-employed technical officer, you may have competitive advantages, limited in time, with contract-placing authorities and private individuals as clients, when you are exempt from revenue taxes (revenue in the first year up to 20,000DM, and in the second year up to a maximum of 100,000DM). This also depends on what payments you must make at the start of your planned self-employment. If, for example, you must invest a net sum of 50,000DM, your input tax claim to repayment for Internal Revenue would equal 7,000DM with a 14 percent revenue tax. In any event, you should discuss the pros and cons of these options with your tax consultant.

The filing of the revenue statement is dependent upon the expected tax liability. If the tax for the current calendar is not expected to exceed 600DM, then an annual revenue tax statement suffices. Otherwise, tax liability up to 6,000DM per annum is to be reported on a preliminary revenue tax statement quarterly (deadlines: 10 January, 10 April, 10 July, 10 October). Tax liabilities exceeding 6,000DM are to be reported monthly in revenue tax statements.

The trade tax is a local tax. Every existing business is subject to trade tax, in so far as its business is carried out domestically. The concept of a business is defined as an independent, ongoing activity undertaken with a profit motive, and represented as an activity within the general, economic and commercial sphere, when the activity is neither seen as the performance of agricultural and forestral trade, nor as the performance of an independent profession, nor as any other independent work as defined under income-tax law.

While joint stock companies, such as limited liability companies and stock corporations, are always subject to trade tax, individual exceptions in trade tax liability exist in the private companies with limited liability, such as companies incorporated under civil law or general partnerships. If you work, for example, with a fellow technical officer and share an office, and you have chosen the legal form of a company incorporated under civil law, you are, nevertheless, not liable to pay trade taxes. Initial variables for the computation of trade tax are the trading profit and the trade capital. Trading profit is calculated according to the regulations of the Internal Revenue Code, or the Corporation Tax Law, whereby, as required by the trade tax law, a few additional items or deductions are figured in.

An example for the computation of the trading profit tax: the technical officers X and Y are owners of a software distribution company, managed under the legal form of a private company with limited liability (for example, a general partnership). Taxable profit is 100,000DM, additional items 11,000DM, and the deductions 5,000DM, bringing the trading profit to 106,000DM. As a private company with limited liability, the software distribution company can apply for an allowance of 36,000DM (allowance does not apply to stock companies) so that the final trading profit is 70,000DM. The tax rate for the trading profit is 5 out of 100, resulting in a tax rate of 5 percent (70,000DM x 5 percent), or 3,500DM This tax rate is reported to the competent local office. The local office then calculated the trading profit tax to be paid based upon its rate of assessment. With average rates of assessment around 400 percent, the local office X would send the general partnership a trading profit notice in the amount of 14,000DM.

With the start-up of a new company, the trade capital tax is levied only in the rarest of instances. Given, that the general partnership has business assets of 200,000DM, the additional items are 50,000DM and the deductions are 30,000DM, a trade capital of 220,000DM results. Assuming an allowance of 120,000DM, which could be applicable to other companies, joint stock companies included, the final trade capital would be 100,000DM. The tax rate for trade capital is 2 out of 1000, so that a tax rate of 200DM is to be expected. Given a rate of assessment of 400 percent, the general partnership would have an additional trade tax of 800DM. The total trade tax of 14,800DM (14,000DM + 800DM) would be deductible as an operating expense.

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SCIENTIFIC AND INDUSTRIAL POLICY

BERLIN CENTER PROMOTES START-UPS, INNOVATION

Duesseldorf VDI NACHRICHTEN in German 10 Jan 86 p 6

[Article by Dieter Beste: "Innovation Fund Attracts Venture Capital. BIG-Tech: The Environment for Start-Up Firms Is Constantly Improved"]

[Text] The fourth floor of the Berlin Center for Innovation and Start-Up Firms (BIG) on Ackerstrasse was almost completely booked to the last square meter: a total success for the "BIG-Tech '85", a trade fair of so-called "innovative company founders", which this year took place for the second time. A small, but distinguished fair and by no means exclusive.

With BIG-Tech, a "market for new technologies," which took place for the first time in 1984 in the building of the Berlin Center for Innovation and Start-Up Firms (BIG), the TU Berlin, together with the city's Economic Senator, has called into being a new trade show geared specifically toward "technology-oriented start-up companies". And so they had come, predominantly from the microelectronics sector.

But also the periphery of technology companies--banks, insurance companies, public institutions for the promotion of business--looked for new contacts at the BIG-Tech.

In part, the demonstrations were decidedly hi-tech, such as the speech dialogue system DEAS of GSP-Sprachtechnologie mbH, which may be used, for example, for the control of microscopes in microsurgery. An interesting item, the two-armed Partal-robot by Ro-Ber, an apparatus for palletizing jobs. At the BIG-Tech, the public was first introduced to a computer-assisted tumor diagnosis method developed by neuropathologist Jose Rafael Iglesias at the Rudolf Virchow Hospital in Berlin.

Berlin, as a location for innovative start-up firms, has several advantages as compared to the State. At the end of 1982, the Berlin Innovation Fund was created with public moneys, a "link" to venture capital. The fund has proven to be an extremely flexible financing instrument, for it is not limited to either a certain innovation phase or a branch or product group. With regard to methods of financing there are also no constraints or specified maximum rates; depending on the individual case optimum financing is made up of credit, undisclosed holding or conitionally repayable allowances. Securities correspond to the requirements in the venture capital business.

The creation of this innovation fund resulted in the fact that in the meantime twelve private venture capital companies with an investment capital of more than 480 million DM are headquartered in Berlin. They procure fully liable own holdings or third party holdings for young technology firms and at the same time provide these companies with management counsel.

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